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OF

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EDITED BY

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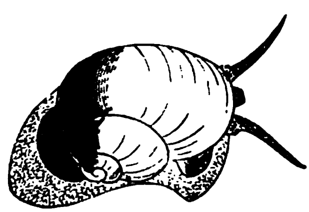
VOLUME III.



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CONTENTS OF VOL. III.

REVIEWS.

NATURAL HISTORY MISCELLANY.

LIST OF PLATES.

LIST OF WOOD-CUTS.

Errata to Vol. III.—Page 3, line 19, for "was" *read* "were." Line 20, for "between" *read* "among." Page 32, line 4, from bottom, mark out the "?" after *Seiurus Novæboracensis*. Page 34, line 14, for "N. W." *read* "Arizona." Page 34, mark out lines 28, and 29 after the word "*Oscines*," and substitute the following:—"yet this bird is a magnificent singer in spring." Page 35, line 10, after "*Vireo olivaceus*," mark out the "? and *V. Bartramii* Swainson." Page 35, line 17, for "*V. gilvus*," read "*V. Swainsonii* Baird." Page 105, line 2, from bottom, for "Raymond" *read* "Haymond." Page 222, line 29, for "Sixteen species of ducks," *read* "six species, etc." Page 285, line 11, from bottom, for "appear in" *read* "upon." Page 455, "*Alcyonella stagnorum*," is a Fresh-water Polyzoan and not a sponge as stated. Page 531, line 7 from bottom, for "tiny" *read* "limy." Plate 10 is marked Plate 9 by mistake.

THE

AMERICAN NATURALIST.

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SHELL-MONEY.

BY R. E. C. STEARNS.

To THE numismatist the love of money is not fraught with evil; his love is not the worship of Mammon or the miser's greed, but rather the ardor of the philosopher or the enthusiasm of the naturalist; he glorifies his coins, not for their commercial value, but for their antiquity or historical associations. As he ponders over his collection, a panorama of past centuries unrolls before him; he sees a long procession of great events, the rise and fall of nations and of men whose emblems and effigies, embossed upon their money, have outlived the national life. More eloquent than written history are these speechless coins. Though silent, they tell of epochs in the lives of the nations they represent, and of eras in the history of the human race.

Notwithstanding the importance of money from an historical point of view, it is not probable that its invention was due to any other cause than commercial necessity; although coins for money are the offspring of civilization, yet the convenience of some medium, less bulky and more durable than ordinary merchandise, by which the differences occurring in transactions of trade or barter may be adjusted, has been recognized by barbarous tribes as well as by civilized people.

The knowledge and use of peculiar narcotics and alcoholic beverages by portions of the human race, both civilized and barbarous, unacquainted with and widely separated from each other is a well-known fact. Analogous to this is the use of some form of money or a medium in trade by isolated and remote tribes.

The earlier coins of ancient Rome appear rude and grotesque when placed side by side with the exquisitely wrought coins and medals of Napoleon the First. But what a degree of civilization and knowledge of the arts do they proclaim when compared with the barbarism of those wild tribes of Africa and America, whose utter ignorance of the arts has led them to use as a substitute for metallic money, the shells of the ocean!

Mr. J. K. Lord, naturalist to the British North American Boundary Commission, during the years 1858–62, mentions the use of shells as money by the natives of the North-west coast of America, as follows:

"It is somewhat curious that these shells (Dentalia) should have been employed as money by the Indians of North-western America; that is, by the native tribes inhabiting Vancouver's Island, Queen Charlotte's Island and the main-land coast from the Straits of Fuca to Sitka. Since the introduction of blankets by the Hudson Bay Company the use of these shells, as a medium of purchase, has to a great extent died out, the blankets having become the money, as it were, or the means by which everything is now reckoned and paid for by the savage. A slave, a canoe or a squaw, is worth in these days so many blankets; but it used to be so many strings of Dentalia."

Mr. W. H. Dall, who has recently returned from Alaska, and whose opportunities for observation have been ample, informs me that the Dentalia are used by the native Alaskans, and that the furs purchased of the Indians by the fur companies, or their agents and traders, are still, at least in part paid for with these shells. This is still farther confirmed by

the facts that the larger European species of Dentalia are imported especially for this trade, and I have myself seen in the fancy goods stores in San Francisco, strings of these shells displayed for sale with beads and other Indian goods.

It is undoubtedly true, as stated by Mr. Lord, that the use of shell-money has, in a great measure, ceased at the points he mentions, as the increased number of white traders and visitors at the principal towns on the coast, as far north as Sitka, has somewhat familiarized the natives with the manners and customs of civilized people, which their natural shrewdness would lead them to adopt so far as it might be to their advantage.

As proof of the "cuteness" of the "untutored savage" in this latter respect, it may be interesting to state that at or about the time of the purchase by and transfer to the United States of the territory of Russian America, attended as it was by the visit of a considerable number of adventurers and others at Sitka, the prices of venison and other game, was, in the language of traffic, so far "marked up" that gold or its equivalent, to the amount of one dollar a piece was charged for salmon, a most exorbitant price, not justified by any greatly increased demand, or by any unusual scarcity of this wonderfully abundant fish in that country.

In the year 1861, during a visit of a month's duration upon the coast of California, at Crescent City, in Del Norte County, I found that in barter between themselves, the Indians used for money the shells of *Dentalium pretiosum* Sowerby, a species that is found all along the North-west coast of America and which, either the shells or the shell-money, is called by the Indians, if I remember correctly, *Alli-ko-cheek* (orthography not warranted correct), and the longer the shells the greater the value, which was reckoned by measuring the shells by the finger joints. I am quite sure that the same species were used by the Indians who live in the Klamath River country in the next county to the south, and who get their name from the river, being known as the Klamath Indians.

Aside from the use of *Dentalium pretiosum* as money, I saw at Crescent City a medicine man belonging to some of the tribes of the neighborhood, who had perforated the grizzly partition which separates the nostrils, and having thrust into the hole thus made two of these shells, point to point, one from each side, for half the length of the shells, perfected this nasal ornamentation by thrusting the feathers of some wild fowl into each of the hollow shells, producing an effect somewhat resembling a mustache.

At Bodiga, much farther to the south on the coast of California, and near the old Russian settlement in Sonoma County, a place visited by me in the month of June, 1867, I was informed by some of the residents that the Indians of that neighborhood, living, however, somewhat back from the coast, used pieces of the bivalve shell known as *Saxidomus gracilis** for money, but why they should use this shell instead of the lustrous and pearly *Haliotis rufescens*, which is fully as abundant, it is impossible to discover.

The use of shells or pieces of shell by the aborigines of North America, was well known and recorded years ago. By reference to the Massachusetts Historical Collections, it will be seen that the early settlers of New England found that shells, or strings of shells, were used by the Indians, both for money and ornament, and were called by them *Wompompeage* or *Wampum*.

The natives of some of the islands of the Indo-Pacific region use the shells of *Litorina obesa*, and they also make very pretty work by evenly fastening these shells to pieces of bark, which, when made, they use for personal ornament. In other of the islands, I have been informed that the banded variety of *Nerita polita* is used for the same purposes.

Cypræa annulus is used by the Asiatic islanders to adorn their dress, to weight their fishing nets, and for barter. Specimens of it were found by Dr. Layard in the ruins of Nimroud.†

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* *Tapes gracilis* Gould. † Woodward's Manual, second edition, p. 233.

The money cowry, *Cypræa moneta*, a native of the Pacific and Eastern seas, is used as money in Hindostan and many parts of Africa. They are chiefly brought from the Maldives, and are an article of trade at Bombay. Many tons weight are annually imported to this country (Great Britain), and again exported for barter with the native tribes of Western Africa. In the year 1848 sixty tons were imported into Liverpool, and in 1849 nearly three hundred tons were brought to the same port.*

Reeve mentions in the second volume of the "Conchologia Systematica," that "a gentleman residing some time since at Cuttack, is said to have paid for the erection of his bungalow entirely in these cowries (*C. moneto*). The building cost him about 4000 *rupees sicca* (£400 sterling), and as sixty-four of these shells are equivalent in value to one 'pice,' and sixty-four 'pice' to a *rupee sicca*, he paid for it with above sixteen millions of these shells."

It will be seen, therefore, that shells have been and are still used as money by a considerable portion of the human race, and it would be quite difficult to point out any other natural production that would be more appropriate or convenient, when size, shape and substance, are considered.

The money of the wild tribes of America, Africa and Asia, one may look for in vain in the drawers of the coin collector. It must be sought for in the museums of natural history, or the cabinets of the conchologist.

THE BOTANY OF CENTRAL ILLINOIS.

BY E. L. GREENE.

In a region of extensive prairies, the monotonous uniformity of the landscape affords none of the conditions for a flora rich in species. Although the soil of these vast

*Baird's Dictionary of Natural History, p. 193.

natural meadows is of almost unparalleled fertility, and its vegetation is always abundant and of luxuriant growth, the number of species is small. While many of the natural families of plants are wholly wanting, and other large ones but feebly represented, two or three for the most part clothe the prairies. These are the Compositæ, the Cyperaceæ and the Gramineæ; or, to use plain English, the compound flowers, the sedges and the grasses.

Let us take a glance at our prairie herbal and notice some of the blanks. First, we find the whole order of the Ranunculaceæ represented only by *Anemone Pensylvanica* and *A. cylindrica*, if we except *Ranunculus Purshii*, an aquatic rarely found in ponds on low prairies. Of the pretty family of violets we find only *Viola cucullata*, and that only occasionally in the low moist places. Passing to the heath tribe (Ericaceæ), one of the most delightful natural orders in all our North American flora, we find not one growing on the prairies of Illinois. And even if we leave the prairie and search the woods and river bluffs ever so thoroughly we still find none.

The Indian Pipestem (*Monotropa uniflora*) will be found rarely in low woods, and is the only species of the order which the writer has observed during two years of botanical research in this section of the country.

There is another still more interesting family, the Orchids. Of these only three are found on the prairies, namely: the White-flowered Ladies' Slipper (*Cypripedium candidum*), a Spiranthes of doubtful species, and the so-called Prairie Orchis (*Platanthera leucophea*). Why the last mentioned plant has received the popular name of Prairie Orchis we cannot conjecture, for it looks, when growing on the prairie, like a half starved and homesick foreigner to one who has seen its luxuriant growth by hundreds in the tamarack marshes of Wisconsin.

"Well," says some New England friend, "your Illinois prairie must be a rather dry field for a botanist in May or

June. These families of plants which you have mentioned as nearly absent from *your* flora are the very ones which furnish *our* spring with all her glories." And we must admit that the loss from our vernal list of the Kalmias, Azaleas, and less gorgeous but more lovely members of the same family is almost an irreparable one; nevertheless if our botanical *confrère* of the East will favor us with a visit next spring we will gladly satisfy him that we are not without our share of vernal beauties. Although the composites are more especially the flowers of the prairie, and we are obliged to wait for the intense rays of the summer sun to call them forth, yet there are a few charming ones among them, the brilliant *Phlox maculata*, which is, as it deserves to be, a frequent tenant of the gardens at the East, also the pretty *Houstonia purpurea*, equally as long as its congener of the New England meadows, *H. cerulea.*

But we shall not take our guest to the prairie for our first excursion. We shall prefer a visit to yonder belt of timber, which we see a few miles in the distance. There we shall doubtless find a running stream with shady bank, and beyond a tract of what is called in western parlance "bottom land," which is simply an open plain, slightly elevated above the low banks of the stream, surrounded by and sometimes covered with timber, and which has a flora different from that of the prairie.

From the moment we enter the timber we find a profusion of flowers. Scattered over all the shaded slopes grows the graceful but odd looking *Dicentra cucullaria.* We say odd looking, because the shape of the flower is so remarkably similar to the outline of a common house fly. Nestling close beside some decaying log we may, perhaps, find *Dicentra Canadensis* with its pure white heart-shaped flowers, not less interesting than its more common sister species. Yonder we see an extensive patch of *Mertensia Virginica*, which with its nodding clusters of richest blue presents a picture of surpassing beauty.

Raising their heads above the foliage of that miniature grove of wild mandrakes are a few specimens of the Yellow Ladies' Slipper (*Cypripedium pubescens*), and below them in stature, but of superior beauty, we find the Showy Orchis (*Orchis spectabilis*). In the groves of the "river bottom" are to be found our New England violets and buttercups, and other species of the same genera which are peculiarly Western, and with them are Phloxes, Erythroniums and other plants equally worthy to be mentioned, but their names would occupy too much space. The elegant *Collinsia verna* must, however, not be omitted, nor the flaming Red-bud, which is now clothed only with its garlands of purple flowers, and rivals in its dazzling splendor some of our choicest exotics.

In August the prairies put on their gold and purple when the Rudbeckias, Helianthuses, Silphiums and other allied genera, appear in flower in about eighteen different species, all having purplish or purple disks and yellow rays. In contrast with these, the purple Cone-flower, Echinacea, displays its long drooping *purple* rays, and more showy than these are the long purple racemes of several species of Liatris. Succeeding these come the Asters and Eupatoriums of different hues, and the Solidagos or Golden-rods and kindred composites of about twenty-five species. Finally in November the Geradias and Gentians close the season of botanizing on the prairies of Illinois.

THE CHIMNEY SWALLOW.

BY AUGUSTUS FOWLER.

This bird arrives at the eastern part of Massachusetts usually between the twenty-fifth of May and the first of June, departing for the South in the latter part of August. Not arriving until the season has far advanced, it is, consequently, the last of the family of swallows to visit its breed-

ing place. After their arrival they visit some unoccupied chimney or hollow tree, which a great number use as a temporary residence during stormy weather, and to roost in. In this as it were aimless gathering-place, they do not long remain, but soon begin to select their companions, and at such times they may be seen high in the air, especially in the middle of an extremely warm day, chasing each other in circles upon extended wings, but without that quick vibrating motion they employ when in pursuit of their prey, uttering the while their peculiar notes; their choice of mates being made they commence building their nests. They are usually placed in a chimney, in which a number of pairs breed, for they colonize the same place to the number of three or four pairs, and sometimes to fifty pairs, more or less. The nest is constructed in a singular manner: it is made of small dry twigs, broken from some dead branch of a tree by the bird flying swiftly against it, and then carried to the spot and fastened to it with a strong viscid substance supplied by their large salivary glands. Each stick is laid near the other and some crosswise, and there glued by the bird until the nest is finished, which is done by spreading over the entire surface of it, as well as the sides of the wall to which it is attached, a coat of the same tenacious gum. It resembles a shelf, containing only a small cavity to receive the eggs, and lacks the soft lining that characterizes the nests of other species of swallows.

In the month of May (1868) a chimney was taken down in the village called Putnamville, in Danvers. It was a large chimney connected with a shoe factory, that had not been used for four or five years. During the time of its disuse a large colony of chimney swallows occupied it to breed in. I had a good opportunity to examine their nests, to take their dimensions, etc., and not one of the many which I saw (and the number of nests were upwards of two hundred) were "lined with a few feathers and straws."

Although their visit is short, they raise two broods in the

season. The first nest being built, the female lays usually four pure white eggs, which measure thirteen-sixteenths of an inch in length, by seven-sixteenths of an inch in breadth, and is assisted by the male in the process of incubation. A few days after the young appear, the male takes them in charge, while the female builds again, as she is seen in the last of June obtaining materials to build or to repair another nest, and thus we see young birds in the same chimney of a different size and age; it therefore requires all the energies of the parent birds to supply their offspring with a sufficiency of food, and claims their labor through the day and a greater part of the night. Some species of the family of finches conduct their family affairs in like manner.

Mr. Audubon, in speaking of the habits of the song-sparrow, remarks: "among the many wonders unveiled to us by the study of nature, there is one which long known to me, is not the less a marvel at the present moment. I have never been able to conceive why a bird which produces more than one brood in a season, should abandon its first nest to construct a new one, as is the case of the present species; while other birds, such as the osprey and various species of swallows, rear many broods in the first nest which they have made, which they return to after their long annual migrations, repair and render fit for the habitation of the young brood to be produced." "There is another fact which renders the question still more difficult to be solved. I have generally found the nests of these sparrows cleaner and more perfect after the brood raised in them have made their departure, than the nests of other species of birds, mentioned above, are on such occasions,—a circumstance which would render it unnecessary for the song-sparrow to repair its nest."

The first nest of the sparrow is occupied by the first brood, and are tended by the male, while the female sparrow has built a second nest and is setting, and by the time the first brood is cast off by him, to care for themselves, he finds

another brood ready for his care; thus all the season is occupied by them in building nests, in incubation, and in rearing their young, until the moulting season arrives, which is about the twenty-fifth of August. The pigeon family breed in a similar manner, except that the young are fed from the crop of the male, and it is truly a greater wonder in nature, that there should exist a sympathy between the male pigeon and his offspring, and that at their appearance his crop should undergo so great a change. The rapacious birds return annually to their old nests, and by repairing them, make them suitable receptacles for their eggs. There is an unfitness in the structure of birds of prey which makes it inconvenient for them to build a nest with the facility of some other families of birds. The white-headed eagle selects some dead branch of a tree, and by hooking her bill on it, with her weight breaks it off. In its descent, she swoops and grasping it with her claws carries it away to make her nest; she pounces upon bunches of hay, sods of earth or any heap of rubbish, and carries it to the already accumulated heap of such substances. There is no artistic skill displayed in its construction; the top of it is merely a horizontal plane, with a shallow cavity to receive her eggs. Some families in this order of birds build better nests, but they show the same unhandy and awkward way in doing it, and there are some species of other families in this order which build no nest.

There are other birds, also, such as the swallows, whose forms are ill-adapted for good nest builders; with small feet and short weak legs it is toilsome for them to gather material for a nest from off the ground. Now observe all those birds whose structure is similar to that of the swallow family. Not one species of the family Caprimulgidæ builds a nest. The whippoorwill lays her eggs on the ground in the woods: the night-hawk on the naked rock, or the bare ground in open pastures. Look at the belted kingfisher, whose form is similar to the above mentioned birds; how ill-adapted he is to gather materials from the ground to form a nest. Al-

though a bird of strong pinion, yet deprive him of the use of his wings, and place him on the land, and he is almost helpless.

In the different species of the Picidæ, or Woodpecker family, are as many instances that the structure of birds determine whether those of certain forms build a nest or not, and if they do, they return to it annually to render it fit for a home for themselves and family during the breeding season.

It is a tedious task for the chimney swallow to procure the material for its nest; it requires energy, skill and strength to perform the work. Flying with force, they grasp the point of the twig with their bill, and often try several times before they succeed in breaking it off. The female visits her former breeding place, and examines her nest; if it needs repairs, she adds more twigs and gum to it, and it is all right again. Thirty years ago this species of swallow was rarely found breeding in Essex County; now many pairs breed in almost every village where they find an unoccupied chimney.

The Chimney Swallow (*Cypselus pelasgius*) does not possess the easy and graceful motion when on the wing that is shown by the Barn Swallow (*Hirundo rustica*) in his flight, but moving more swiftly and vigorously, they must destroy an innumerable number of insects in a season. It not unfrequently happens that their nest is dislodged from its place, and falls in consequence of rain or damp weather. When such accidents happen, the whole brood is precipitated to the bottom of the chimney. If its members are of sufficient age and strength, they will climb up again and remain clinging to its sides, until fledged and able to care for themselves.

There are occurrences happening to them which are of greater moment. Sometimes having selected a flue in the chimney leading to the bedroom, and having there brought forth their numerous young, and their cares consequently increasing so as to require their labors in the night, the rushing whirring noise of their flight as they pass up and

down the flue may so disturb the nervous sleeper that he is determined to be rid of such an annoyance; he accordingly prepares in the habitation of these birds a fire of straw; the parents of the unfledged young flee in dismay, and rise above their smoking tenement and wheel about in terror, then dive down near its top as though they would rescue their suffocating brood from a death so awful. At last their courage gone they turn and soar away above the scene, while their young drop one by one in the fire below, and the parental feelings of the old birds induce them to linger about their desolate home for many days. To obviate this inhuman practice, a board placed on the top of the chimney before they commence breeding is all that is necessary.

THE STRUCTURE OF THE PITCHER PLANT.

BY J. G. HUNT, M.D.

"High among the mountains,
Near the bubbling fountains,
Where the trees bend low,
Where the wild flowers grow,
'Mid the shadows deep"
Nepenthe's pitchers weep.

About twenty species of the genus Nepenthes are known to botanists, and while some are natives of swamps in Africa and China, most of the species are found on Mount Kinau Ballou, in the Island of Borneo, growing at an elevation of from three to eight thousand feet above the sea. The species whose minute anatomy we partially describe, is the *Nepenthes distillatoria*, found growing in China and at the Cape of Good Hope. This plant often attains the length of ten or twelve feet, generally lying prostrate, or partially supported by other plants. It bathes its roots in the hot swamps near the coast, but cannot lift its flowers very high in the sunshine, because its branching stem which bears many long and partly clasping leaves, and also its precious

burthen of watercups, is too feeble to support the weight. Seldom does the stem exceed two inches in diameter, being long and flexible like a rope.

Fig. 1.

Now, as all readers of the NATURALIST may not be botanists, we will state that the plants in question bear on the ends of their leaves peculiar appendages not unlike pitchers in form, and hence they are commonly known as pitcher-plants. Like the pitchers we use for domestic purposes, they are often colored with many gorgeous tints, and fashioned into graceful shapes, often with a capacity to hold more than a quart of liquid. As nature is seldom outdone by art, these forest cups have the ability to fill themselves, thus differing in an important respect from the pitchers we use.

For a long time it has been a question where this liquid came from, and our knowledge of the subject is still too limited to say from what part of the plant it is poured out, though *it is probable* special glands have been set apart to perform that function. To decide this question, certainly, would require close observation on the living pitchers, and that would be very difficult, because in their early stages of growth they are tightly closed by the curious lids at the top, and in the young state excretion is most rapid and copious.

Fig. 1 is an accurate drawing made (half size) from a pitcher that had been rendered transparent in order to show

its venation, and the position of both sets of glands. Minute dots, commencing at the bottom and extending to high-water mark,* represent the position and number of one series of glands, all on the inside of the pitcher. The under side of the lid also is covered with similar glands, having among them, however, numerous stomata.

Fig. 2.

Fig. 2 shows a camera lucida drawing (magnified eighty diameters) of these glands, also rendered transparent, so that their anatomy may be seen at one view. They are depressed below the inner surface of the pitcher, and have, extending over nearly half the diameter of each, a projection of the epidermis like many little roofs, so that a stream of water poured in at the top would reach the bottom of the pitcher without touching a gland. The fine reticulation marking the surface of each, is caused by the ends of long columnar cells making up the gland structure, and these columnar cells rest on others of larger size, shown in the drawing. All the parts just described are best seen by a perpendicular section (Fig. 3, magnified one hundred and sixty diameters), and it may also be observed that each gland lies immediately over large isolated and *spiral* cells, which have no vascular connection with the ordinary spiral structure of the plant.

Fig. 3.

In a description, without illustrations, of this series of glands, published in the "Edinburgh New Philosophical

* Crossing the middle of the pitcher; the dots are omitted in the figure.

Journal" for 1832 and 1833, by Treviranus, he says the cuticle does not cover the glandular surface; it is, however, very easy to demonstrate that it is reflected down over each gland, and whatever liquid is excreted must filter through this cuticular covering before it falls into the pitcher.

By referring again to Fig. 1, it will be seen that a thickened margin or frill surrounds nearly the entire top of the pitcher. Now, embedded in this fleshy frill, lie many elongated, cylindrical glands, like guns on a fortification, all opening on its inner side by minute ducts which lead up to the glands. The size of these very peculiar organs varies, as shown in Fig. 4 (magnified eighty diameters), and sometimes they are united at the ends, though this can be regarded only as a curious malformation. The drawing shows the union of the ducts with each gland, and also their cellular structure, better than many words could describe it. In a side view of one of these glands, we see it is somewhat crescentic in shape; the orifice of the duct is apparent, and also the position of the gland with respect to the epidermis which covers the frill. This second series of organs lies embedded in a tissue, made up chiefly of large, isolated, spiral cells, developed to a degree not found probably in any other plant. Treviranus seems not to have been aware of these upper glands in Nepenthes, nor have we seen them noticed by any authority before.

Fig. 4.

In describing the structures alluded to in this paper, we have used the term gland for want of a better one, but we do not therefore assume any speciality of function. This is a point about which we are ignorant. The structure of an organ will not enable us to predict its function, though it

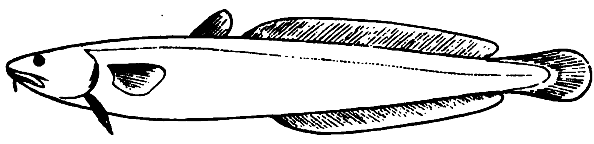
may afford rational ground for guess-work. Will not some one having the opportunity make observations on these singular organs in the living plant, in order to settle their function? We know not anywhere else in the vegetable kingdom organs more *apparently* set apart for a special purpose, and yet we are in doubt about their meaning.

Our native Sarracenia growing abundantly in swamps, with its cups, often the graves of drowned flies, is also called a pitcher plant, but differs widely in structure and habit from the Nepenthes. We allude to it now only to express our intention, if opportunity should offer, to illustrate its singular structure, as well as that of others of these remarkable plants, which nature *seems* to have appointed to set their traps among the swamps, but for what purpose, perhaps, we are not ready to explain.

We have been assisted in illustrating this paper by Miss Mary Peart and Miss Emma Walter, and the drawings were made from specimens in our possession.

THE COMPRESSED BURBOT OR EEL-POUT.*

BY WILLIAM WOOD, M. D.



Of the genus Lota, there are several species. The English Burbolt (Burbot), as described by Yarrell in his work on British fishes, and by Couch, belongs to this genus, yet probably is a different species from any in our lakes and rivers. Couch says, "the Burbolt (Burbot) is the only one of the extensive family of the codfishes which has its residence in fresh water, where it is distinguished by exhibiting some of

* *Lota compressa* Lesueur.

the manners of the eel, by which it has obtained the name of the eel-pout."

In this country, according to DeKay, we have three species: the Plain Burbot (*Lota inornata*) which is rare, the Spotted Burbot (*Lota maculosa*) which is abundant in our lakes, and the Compressed Burbot (*Lota compressa*) which is very rare.* DeKay, when he published the Fauna of New York, in the Natural History of that State, says, "the *only two specimens described* are from the Connecticut River and its tributaries. I know it only through the descriptions of Lesueur and Storer."

This species was first described by Lesueur from a specimen taken at Northampton, Mass. The second description was by Dr. D. Humphreys Storer, of Boston, from a specimen taken in the Ashuelot River. In his report on the Fishes of Massachusetts, page 134, published in 1839, he says, "the only specimen I have been able to see was sent me from Keene, N. H., taken in the Ashuelot River." In the Catalogue of the Fishes of Connecticut, by Rev. James H. Lindsley, in the American Journal of Science and Arts (Vol. 47, page 71) he says, "I obtained a fine specimen (*Lota compressa*), taken a few years since in New Canaan, Conn." In Dr. Storer's article on the fishes of Massachusetts, published in the Memoirs of the American Academy of Arts and Sciences (new series, Vol. 6, part second, page 360, published in 1858) he says, "the one from which this description was taken, was brought from the Connecticut River by Thomas M. Brewer, M. D., of Boston." If Dr. Storer refers to two specimens in his reports of 1839 and 1858, we have four specimens described; if to but one, *only three specimens have ever been described* so far as I can learn.

The specimen which I have before me was taken in Scantic

* All these species have been considered by Dr. Günther, in his Catalogue of Fishes in the British Museum, as one and the same species with the European Burbot. *Lota maculata* and *L. inornata* are undoubtedly synonyms, but until farther comparisons have been made we are inclined, with Dr. Wood, to leave *L. compressa* as a distinct species, and also to question the uniting of the European and American species.—EDITORS.

River, a tributary of the Connecticut, about four miles from East Windsor Hill, May 22, 1868, and was brought to me in a tub of water, which gave me a good opportunity to examine it in its natural state. There was one taken in the Farmington River, some six miles from this place, in an eel-pot a few years since, and was kept alive for several weeks.

The description given by Dr. Storer, in the two reports referred to, is so full that but little which is new can be added. The length of those described by Lesueur and Storer, were six and eight inches; by Lindsley, eleven and a quarter inches. The one before me is eleven inches long.

Color.—The back and sides are yellowish brown, with irregular patches of a darker color, marked somewhat like our pickerel, only a shade darker; the gill covers and snout are dark brown, the belly is of a light color in place of the yellowish on the sides; the first dorsal fin is lighter than the body; the second dorsal and caudal fins are dark at the base, yellowish in the middle, with the edge margined with black or dark brown; the anal fin is similarly marked, though a little lighter; the black margin is not as wide as on the dorsal.

Description.—The body is shaped very much like an eel, being cylindrical; the abdomen rather more prominent than in the eel. The head measures one and three-quarter inches in length and is compressed above. The sides begin to be compressed at the tip of the pectorals, and continue to be more so until it terminates in the caudal fin, which appears like a membranous continuation of the body; the tail fin is fan shaped, and measures one and a half inches in length at its longest point. The first dorsal is quite small, and is two inches from the head. The second dorsal is situated a quarter of an inch back of the first dorsal, and terminates at the base of the tail, and is rounded at its posterior extremity. The anal fin commences an eighth of an inch lower down than the dorsal, and terminates in the same manner. The ventral fins measure seven-eighths of an inch in length, and are composed of two free rays, one ray measuring five-

eighths, the other one-fourth of an inch. These free rays are used by the fish as feelers, in the same way as the barbel on the chin. The pectoral fins measure one and an eighth inches in length, and have one very minute free ray. On the chin is one barbel half an inch in length. The nostrils are double; from the back of the anterior nostril is a minute barbel. The eyes are circular, and three-quarters of an inch apart. Both upper and lower jaws are armed with minute teeth. The whole surface is covered with exceedingly small cup-shaped scales, which are not plainly visible except by the aid of a magnifying glass.

In the description given by Lesueur, Storer, Lindsley and DeKay, no mention is made of the free rays of the ventral fins. They are as distinct and noticeable as the barbel on the chin, and more so when swimming.

It is thought by some that *Lota compressa* and *Lota maculosa* are identical. I am not sufficiently versed in ichthyology to be a dictator or judge in the matter, yet the habits and dimensions of the two are so dissimilar as to lead me to suppose that they are two distinct species. The *Lota maculosa* is two feet in length at maturity. The largest *Lota compressa* ever known was the one described by Lindsley,—eleven and a quarter inches. The *Lota compressa* probably visits the salt water, as it is taken in ascending the Connecticut or its tributaries in the spring of the year, in company with fish from the salt water ascending to spawn. So few have been taken that it may not be wise to be positive in this assertion, yet I have no doubt, in my own mind, that it is a fact. Four have been taken to my knowledge within six miles of my office, within a few years, and all have been taken in the spring. Three of them were taken in company with the Lamprey eel (*Petromyzon Americanus*), in pots set for them, and the fourth (the one in my possession) was caught in a fine net with a promiscuous collection of fish.

The Spotted Burbot, on the contrary, lives exclusively in fresh water.

As I have called the attention of the fishermen in this vicinity to the rarity of this fish, I shall probably get specimens that would otherwise have been thrown away, and hope to gain farther information respecting this uncommon species.

SALT AND FRESH-WATER CLAMS.

BY EDWARD S. MORSE.

We choose these two animals for description since they are accessible to all. The inland student may rake from the pond or river the fresh-water clam, or mussel, in quantities, while the sea-side student has only to step into the market and order the salt-water clam by the bushel.

In presenting such descriptions for study, it is always best to cite as examples those forms which are most abundant, so that whatever statements are made can be quickly verified by an examination of the object described. A general knowledge once attained of the common animals, prepares one to enter farther into the study of zoölogy, and enables him, through the facts already garnered, to use his information in the prosecution of new investigations. We commence, then, with the description of an animal, about which little has been said except in books professedly scientific; an animal, however, long and well known from the cheap and excellent food it affords, and from its no less importance in providing bait for our fishing fleets.

That the daintiness of the clam for food was known to the aborigines of this country, is well attested by the huge piles of broken clam shells scattered along our eastern coast, and now buried beneath a foot or more of soil. Mingled with these piles the archæologist reaps a rich harvest of Indian relics, such as implements made of bone, fragments of pottery, etc.* These are the only evidences of by-gone

* In the NATURALIST, Vol. I, p. 561, Prof. J. Wyman describes the contents of some of these beds, with illustrations of the various relics.

tribes which have left their records in the remains of their feasts.

From an old book published in London in 1636, entitled "New England's Prospect," etc., it would appear that the squaw performed the hard work then, as now, and that, unimpeded with trailing skirt, she waded over the mud-flats in search of clams for her indolent master. From this book we make the following extract, more quaint than elegant, describing the "kinds of shell-fish."

"The luscious lobster, with the crab-fish raw,
The brinnish oyster, mussel, perriwigge,
And tortoise sought by the Indian Squaw,
Which to the flatts dance many a winter's jigge,
To dive for cockles, and to dig for clams,
Whereby her lazy husband's guts she cramms."

The shells also came in good use as table utensils, and from a work published about the year 1676, entitled "New England's Crisis," by Benjamin Thomson, the prologue commences thus:

"The times wherein Old Pompion was a saint,
When men fared hardly, yet without complaint,
On vilest cates, the dainty Indian maize
Was eat with clamp shells out of wooden trays."

Thus much for its historical interest; and now let us at once enter into an examination of the animal itself. A clam, as we find it in the market, does not certainly present a very inviting appearance. The two bluish white shells hold within an unintelligible yellowish mass, while projecting from one end is a wrinkled blackish lump, that upon being irritated withdraws within the shell, throwing out at the same time a stream of water, the shells meanwhile shutting together tightly. To appreciate the natural appearance of the animal, we must place it in its natural element—the sea-water. Be sure and get a dish long enough for its first stretch. A shallow pan twelve or fifteen inches in length will be sufficient. Having filled the pan with fresh sea-water and immersed our clam in it, we wait patiently, or leave it for a while, perhaps half a day; but finally the

blackened tube, improperly called the "head," gradually protrudes beyond the margins of the shell. Slowly extending, it attains the length of three or four inches, and now we notice that this organ has two openings at the end, beautifully fringed with appendages like little feelers, and mottled with the richest brown. And this tube, then, is really a double tube leading to the body of the clam. Notice carefully the opening and you will see a current of water pouring in at one of them, and as steadily flowing out of the other. These currents are produced by the tremulous motion of innumerable minute hairs, or cilia, which line the interior of the animal.

The clam has no power to seek its food, being confined to its burrow in the sand or mud. Its food consists of minute particles of organic matter floating in the water, and thus it is through the medium of the ingoing current of water, that nourishment is carried to it. While the water conveys food to the mouth, it is also charged with oxygen to revivify the blood; for the clam has blood, and a heart, and vessels to circulate it. What admirable uses do we see already in the so-called head of the clam. Lying buried as it is to a considerable depth in the mud, these tubes are thrust to the surface to conduct the pure water laden with nourishment for the stomach and gills. The water, as it passes out through the other tube, carries with it all excrementitious matter and other waste from the body.

In the "Annals and Magazine of Natural History," Messrs. Alder and Hancock describe the appearance of these currents. From their account we extract the following: "We lately have had an opportunity of observing *Mya arenaria* in its native haunts, and watched the play of its siphonal currents under very favorable circumstances. This species, at the mouth of the Tyne, buries itself to a depth of six or eight inches in a stiffish clay, mixed with shingle; and in shallow pools left by the tide the tubes may be seen just level with the surface of the muddy bottom in full action.

The mud lies closely packed against the walls of the tubes, so that nothing is seen but the expanded lips of the siphonal orifices fringed with numerous tentacles. When it happens that the surface of the water is only a little above these orifices, a strong current can be distinctly seen to boil up from the anal siphon, and another, with a constant steady flow, to set into the branchial one."

On plate 1, fig. 2, is represented a clam in its natural position in the mud, showing the extent to which the tubes, or siphons, can be extended; and in Fig. 1 a clam is represented with one of the shells—the left shell—removed. As we remove the shell, we are forced to separate two muscles which hold the shells, or valves, as they are called, together. The valves are forced apart by an elastic substance that occupies the little tongue-shaped tooth of the shell near the hinge, and in order to keep the valve together, the clam has to exert a constant force by contracting the muscles. The moment the muscles relax, the elastic substance forces the valves apart, acting as a piece of India-rubber would act if placed within the hinge of a door, and the door closed against it. Fig. 4, plate 1, represents a section of the valves of a clam, showing the elastic substance, L, and the transverse muscle, M.

Having opened the clam, we find lining the shells within a thin membrane called the mantle. Its border which follows the edges of the shell, is thickened and united, except a small slit through which the so-called foot projects. This organ has the power of excavating a hole in the mud. According to one writer, it assumes a variety of shapes while digging: "now a dibble or spade, a trepan or pointed graving tool, a hook, a sharp wedge."

The abdomen occupies the centre line of the body, and forms the principal edible portion of the clam. It contains the ovary and liver,—the liver being recognized by its dark color. (For the different parts see plate 1, and explanation of the plate.) The mouth of the clam is directly under the

forward transverse muscle. It will be seen by the position of the mouth, that the so-called head of the clam is not the head at all. One may call it the tail with more propriety, though it is simply two tubes united together, projecting from behind for the purposes before mentioned. On each side of the mouth are a pair of lappets or palpi; these probably assist in directing the minute currents of food into the mouth. The mouth opens almost directly into an irregularly shaped stomach. The intestine, after several turns in the abdomen, passes along the back, going directly through the heart, and terminates above the posterior muscle. Fig. 7, plate 1, represents the heart as seen from above. This consists of a ventricle (V) and two auricles (A), one on each side, which takes the blood from the gills. The gills are two in number, and hang from below the back, on each side of the abdomen. The thickened portion of the base of the tubes, commonly called the shoulder, are muscles to draw in the tubes. Space will not allow us to enter farther into the anatomy of the clam. We may add, however, that nearly all bivalves are organized in a similar way. We give a transverse section of a fresh-water mussel to show the various organs. (See the plate and explanation.)

The clam is used for food in Europe, Asia and America. Jeffrey says, "it forms one of the numerous articles of Chinese diet, being brought to market after having been boiled for a long time, and cooked with a seasoning of which onions are a base. The people call it Tsega." Fabricius states that in Greenland the clam is eaten by the walrus, Arctic fox, and birds.

In the fresh-water clam, instead of two long tubes covered by one sheath as in the sea-clam, we have two short tubes, one only being separate, the other merging into the mantle, which is open throughout; though by reference to the plate it will be seen that the tubes bear a general resemblance to those of the sea-clam. In the fresh-water clam the elastic substance opening the shells is outside, and pulls them apart when the

muscles relax (Pl. 1, fig. 5). While the sea-clam lies buried in the mud, head downward, with but little power of locomotion, the fresh-water clam has the faculty of moving through the mud or sand in which it lies partially embedded. Fig. 6, plate 1, represents the natural attitude of the Unio, or fresh-water clam. It will be seen that the tubes are above the level of the sand. The foot is very large, and with it the Unio is enabled to move along slowly, the shell wedging its way through the sand, leaving a groove or furrow along the river bottom, and often the collector takes advantage of these tracks in finding them.

But little is known regarding the development of the sea-clam, or Mya, as it is technically termed, but it is similar to that of the Unio. In these the eggs issue from the ovaries, and find their way into the cavities of the outer gills. There they develop until they are furnished with a little triangular shell, large enough to be recognized by the unassisted eye. At this stage they are discharged by thousands into the water, and are left to take care of themselves. It has been ascertained that they attach themselves by a little thread to the river bottom, thus preventing them from being swept away, though it is probable that not one in a hundred ever reaches maturity, as fishes and other aquatic animals feed upon them. Fig. 8, plate 1, represents the shell of the young Unio.

Many of the common fresh-water clams produce pearls, though the black mussel, with a white pearly interior, oftentimes produces pearls of considerable clearness. These pearls are caused by particles of sand or other irritating substance getting in between the mantle and shell. This irritates the animal, and this irritation causes the animal to deposit upon the particle layer after layer of pearl. In China, the natives taking advantage of their knowledge of the way in which pearls are formed, have shown their ingenuity by making flat lead castings of their little idols. These they insert in a species of fresh-water clam, by first wedging the shells

Fig. 1.

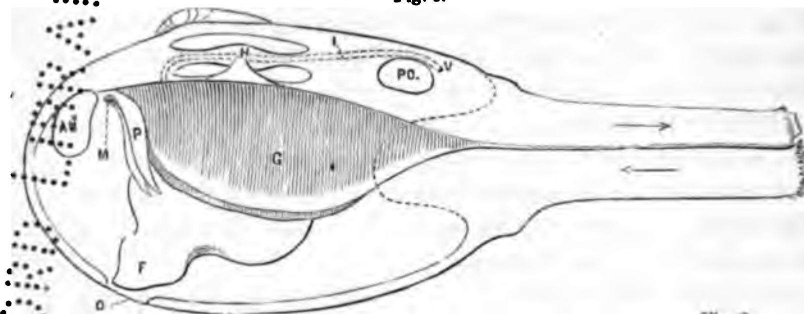


Fig. 2.

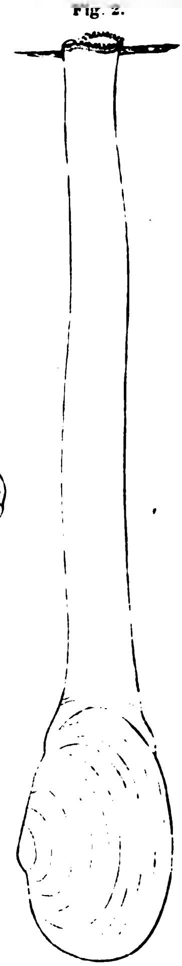


Fig. 4.

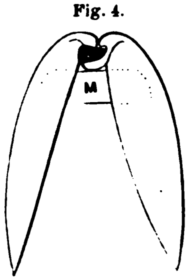


Fig. 5.

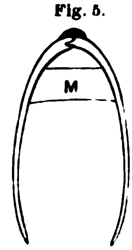


Fig. 3

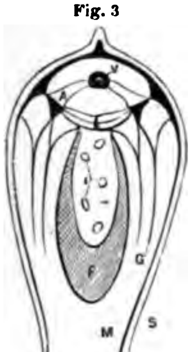


Fig. 7.

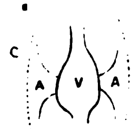


Fig. 8.

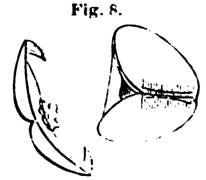
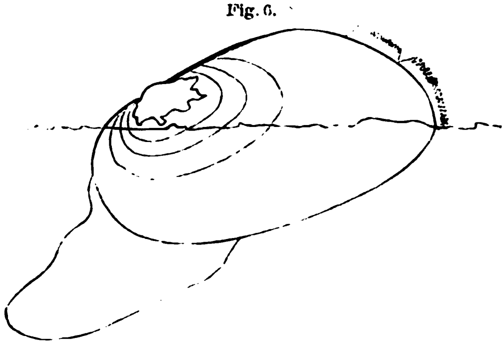


Fig. 6.



MORSE ON SALT AND FRESH-WATER CLAMS.

apart, and then slipping the idols in between the mantle and the shell. After a lapse of time they collect the shells and open them, and adhering to the interior of the shells they find the little lead images coated with a layer of pearl; these are neatly cut out from the shell, and are worn as charms.

It is a matter of wonder that some enterprising Yankee has not had recourse to this, as a novel mode in getting up shirt studs and sleeve buttons.

All these shells increase in size by depositing lime around the margin of the shells, and the concentric lines upon the outside of these shells indicate successive periods of growth and repose.

For additional information regarding another species of bivalve, the salt-water mussel, the reader is referred to Vol. II, p. 243, of this Magazine.

EXPLANATION OF PLATE I.

Fig. 1. Sea-clam, *Mya arenaria*, with the left valve removed. H, heart, I, intestine; G, gills; P, palpi; M, mouth; A N, anterior transverse muscle, technically anterior adductor. P O, posterior adductor; F, foot; O, opening in the mantle for foot; V, vent. This figure represents the clam with its back uppermost, and the anterior end turned to the left.

Fig. 2. Sea-clam in its natural position in the mud, head downward, showing the tubes extended to the surface of the mud.

Fig. 3. Ideal transverse section of fresh-water clam, *Unio*. I, intestine; F, foot; V, ventricle; A, auricle; G, gills; M, mantle; S, shell.

Fig. 4. Transverse section of *Mya*, showing the position of the spring to open the shell. M, muscle; L, ligament.

Fig. 5. Transverse section of *Unio*, showing the position of the spring to open the shell. M, muscle; L, ligament.

Fig. 6. Fresh-water clam, *Unio complanatus*, in its natural position, crawling. The anterior end is depressed, and the foot is seen thrust out ahead.

Fig. 7. Heart of clam seen from above. V, ventricle; A A, auricle; G G, line of gills.

Fig. 8. Young of *Unio*.

THE SENSES OF SIGHT AND SMELL OF THE WILD TURKEY AND THE COMMON DEER.

BY J. D. CATON.

It is claimed for the wild turkey that it has the quickest and most accurate sight of any known animal. It is a saying among old hunters that it can detect the human eye looking through a knot-hole from the inside of a hollow tree. I once observed an incident illustrative of its remarkable power of sight, and tending to show that its apprehension of scent is correspondingly dull.

In December, 1847, I was hunting deer on the Vermilion River, and had been following one from daylight till three o'clock in the afternoon, over the breaks and bluffs of the Vermilion River, through six inches of dry hard snow, almost as difficult to walk in as dry corn-meal. When near the foot of the bluff, not far below the mouth of Deer Park, some distance off, I saw a flock of wild turkeys crossing the river on the ice, and coming directly towards me. My ambition immediately fell from a deer to a turkey. I concealed myself in a very dense thicket of underbrush, and soon heard the turkeys approaching with that contented *quit*, *quit*, in which they frequently give expression to a happy sense of security. My pointer, which was as good at following a deer as a grouse, stood at my feet without moving a muscle, though his eyes shone like balls of fire when he scented the turkeys and heard them pass by. They passed, I should judge by the noise, not more than fifty or sixty feet from me, without taking the least alarm. About fifty yards distant there was a bare spot of considerable extent, near the brow of the bluff to which their course would evidently take them, where I promised myself a sure shot. I rested my gun against a small tree that I might make no perceptible motion before

firing. All but my head and arms was concealed by the bushes, even from the elevated position where I expected they would come in sight, and from an observation on a level with myself I was entirely concealed. I thus stood, anxiously listening to the birds, and so was enabled to notice their progress, and thus determine at what moment to expect their appearance in the open space. The first that appeared was the head and neck of the old cock that led the flock. It seemed as if he raised his head for the express purpose of looking at me, for the instant his head appeared he stared fixedly towards me, and gave the loud quick note of alarm. In a second or two he took wing, followed by the rest of the flock. I still think he was in a little doubt, else he would not have remained an instant after seeing me, and when he did fly, instead of going directly away, he passed near enough over me to satisfy his doubts.

The eyes of the turkey are so situated as to embrace within the range of vision a very large field. Here we see the sight was very quick if not absolutely certain. Although they had passed very near us, the sense of smell had given them no intimation of our presence.

While I stood there, my gun still resting against the tree, deeply chagrined at what I supposed the last chance for game that day, for I was too much fatigued to track farther, I heard the brush crack, and in an instant the largest buck with the largest horns I ever saw, stopped not more than thirty or forty feet from me. While I could distinctly make out his form, the bushes were too thick to allow the hope that I could reach him with a bullet. My only chance was to wait till he should pursue his course, which would bring him through a short space where the bushes were lower, and I might get a shot on the bound when his body would be above them. He stared at me some seconds, as if something told him of danger; but at length he seemed to become reassured, and bounded along in his original course as if he was in somewhat of a hurry, but not in manifest alarm. As

I anticipated, on his third or fourth bound he gave me a chance; and I fired as he was descending. His heels flew into the air with a snap as if his hoofs would fly off, and he fell all in a heap. There was something in the size of the deer and of his horns, the way in which his hind legs, as quick as lightening, stretched almost perpendicularly in the air, and the mode of his falling, which produced a thrill of delight which I have never before or since experienced. I reloaded as quickly as possible and approached the spot where he fell. The first sight told what was the matter. He had raised himself on his forefeet, and was looking fiercely around for an enemy, every hair on his shoulders and neck standing forward, and his eyes glaring with the ferocity of a demon. All behind his shoulders appeared quite inanimate and as wilted as a rag. His backbone was severed just behind his shoulders. It took another shot in the head to induce him to let me bleed him. By the time this was done, a little old man, with a rifle on his shoulder, made his way through the bushes to where I stood, and looked at my trophy in a most disconsolate way. At length he remarked, without taking the least notice of my salutation, "Well, you have got him." To this manifest truth I assented, and asked him to help *slue* the deer around that he might bleed the better, as he was rather heavy for one to handle. "Excuse me," said he, "I have been following that rascal ever since daylight. I am a good way from home with no time to spare;" and away he hurried before I had time to offer to divide the venison with him. Probably that is not the only instance in which one has lost a supper by being in too great haste.

Although the deer had his attention arrested by the scent, and in full view of my entire form, and of the dog standing at my feet, yet from not seeing the least motion, he could not make us out.

THE FAUNA OF MONTANA TERRITORY.

BY J. G. COOPER; M. D.

(Continued from page 600, Vol. II.)

II. BIRDS.

RICHARDSON'S PEWEE (*Contopus Richardsonii*).

FLYCATCHERS (*Empidonax pusillus*, *obscurus*, and *minimus*). These being the species found at Fort Bridges, I suppose one or more of them to have been among the small flycatchers I saw in the mountains. They were exceedingly shy, and though I shot one or two I did not find them, as they fell or hid among thick bushes.

SWAINSON'S THRUSH (*Turdus Swainsonii*). I heard the low call note of this bird in the early morning and evening throughout the mountains, but rarely saw it, as it was very shy and watchful,—more so than *T. ustulatus* on the west coast. Its note and habits were otherwise similar, but I heard no song from it on account of the late season. They were migrating south in September, and common at Cœur d'Aleñe Mission up to the 22d. Near Fort Colville I also saw this or *T. ustulatus* still later.

ROBIN THRUSH (*T. migratorius*). Not abundant, but seen all along the route except in the dense forests. At Milk river I found a nest, with eggs, built in a split trunk of a half fallen tree.

OREGON ROBIN (*T. nævius*). I found this beautiful thrush common near the summit of the Cœur d'Aleñe Mountains about September 10th, frequenting the exceedingly dark and damp spruce forests, which seemed to be its favorite summer residence as at the mouth of the Columbia river. I was surprised to find many of them about Fort Vancouver as early as October 28th, where I did not see them in 1853 until December. There had been an uncommonly early fall

of snow on the Cascade Mountains, which probably drove them down.

Eastern Bluebird (*Sialia sialis*). I noticed this species at the mouth of Milk river, and as this is within sight of the first range of mountains, their base may be considered as its western limit. I saw it also near Fort Laramie in 1857.

Arctic Bluebird (*S. arctica*). I saw a few of this species on the eastern slope of the Rocky Mountains only, and at a high elevation. I have no doubt, however, of its also frequenting some parts of the western slopes, and Nuttall says that he saw it at Fort Vancouver in the winter. It is more shy and silent than either of the other species.

Western Bluebird (*S. Mexicana*). None of the Western Bluebird were seen until reaching Spokan river, north and west of which it is found wherever there are trees, shunning only the dense forest.

Ruby-crowned Wren (*Regulus calendula*) and Golden-crowned Wren (*R. satrapa*). Seen in small nnmbers throughout the Rocky Mountains.

Water Ouzel (*Hydrobata Mexicana*). I was surprised to find this Ouzel scarce in the Rocky Mountains, having seen none myself, and only one being observed by Capt. Floyd Jones, whose attention was attracted by its peculiar habits. This was just east of the Cœur d'Aleñe Pass.

Macgillivray's Warbler (*Geothlypis Macgillivrayi*). Young birds and old ones in fall plumage were common all across the Rocky Mountains, even near the summits, but I saw none in the dense forests of the Cœur d'Aleñe Range, which they seem to avoid as they do those of the Coast Range in Washington Territory.

Water Thrush (*Seiurus Novœboracensis?* No. 70). Hell Gate river, August 24th.* Though smaller than the average, this specimen agrees closely with some in Baird's Report from Pennsylvania and Florida. I found it pretty common in the

* Length, 5.75; extent, 9.25; wing, 2.87; Iris and bill, brown; lower mandible and feet paler.

Rocky Mountains, as far west as the Cœur d'Aleñe Range, and I noticed no difference in its habits or in its single call-note of this season, from those of eastern specimens. I did not notice it along the Missouri, nor did Dr. Hayden collect it above Vermilion river, near the Iowa line.

AUDUBON'S WARBLER (*Dendroica Audubonii*). This was the only bird of the genus I saw. It was very common throughout the mountains, and I have found it in every portion of the country west of them, even where there was scarcely a bush to be seen.

REDSTART (*Setophaga ruticilla*). The Redstart was one of the commonest birds in the Missouri bottom-lands, and I found several of its nests between Fort Union and Milk river, in June. It continued pretty common as far west as the Cœur d'Aleñe Range.

WESTERN TANAGER (*Pyranga Ludoviciana*). Less common than near the coast, but reaching the east base of the Rocky Mountains, though not seen down the Missouri river. The specimen preserved is larger than any measurements recorded by Baird.

BARN SWALLOW (*Hirundo horreorum*). The Barn Swallow occurs in small numbers entirely across the Great Plains of Nebraska, but seems to limit its summer residence to tracts where it can find caves in which to build, as I saw no sign of its nests about the trading posts, where the more abundant Cliff Swallow has full possession of every available position for a nest. I saw the former, however, near Fort Benton in July, and in some parts of the Rocky Mountains afterwards.

CLIFF SWALLOW (*H. lunifrons*). Swarms of this species occurred at every suitable cliff along the Missouri, and across the Rocky Mountains to Cœur d'Aleñe Mission, where they remained until September 18th.

SWALLOW (*H. bicolor* or *thalassina?*). I saw a flock of one or the other species flying over Bitterroot river, about September 1st, and remarked them because I had not seen

any species for several days in that thick-wooded valley (near the crossing), and supposed all the Swallows had gone South. Though both of these probably inhabit that region, I am not sure that those seen were of either species, as they had a strange look, and flew too high to be shot or closely observed. They were white beneath, with the tail a little forked, and may possibly have been Bank Swallows.

CEDAR BIRD (*Ampelis cedrorum*). The Cedar Birds were very abundant in the open pine woods of the main Rocky Mountains, and evidently had nests in August, as they were scattered, and commonly seen searching for insects among the pine foliage, etc. Also common at Cœur d'Aleñe Mission. I saw nothing of the larger Waxwing, which I have since found as far South as Fort Mohave, N. W., January 10th, 1861.

TOWNSEND'S FLYCATCHER (*Myiadestes Townsendii*). I saw only the specimen preserved, which I shot at the eastern base of the pass over the Cœur d'Aleñe Mountains. It was there pursuing insects from bush to bush in a small prairie or "opening," silent, and in every respect resembling the Pewee and other birds of that family in habits. I have remarked the same of *Phainopepla nitens* of Southern California, a bird closely related to this, and in habits very unlike the Waxwings, at least in winter. The Shrikes, however, resemble these birds more than the Waxwings or the Vireos, with which Baird associates them. The tarsal scales would remove both, and the Waxwings also, from the order of OSCINES, and I never heard them sing. (No. 103 is in plumage apparently young, and undescribed.)

SHRIKE (*Collyrio excubitoroides?* or *elegans?*). Both in 1853 and this year, I saw Shrikes on the Columbia Plain in October, which seemed to me to be quite different from *C. borealis*, and to resemble *C. excubitoroides* which abounds through the plains of Nebraska and across Oregon to California. They were so wild that I could not get near them, and in habits, flight, etc., resembled the latter. *C. elegans*

was furnished to Swainson by the Hudson Bay Company, and was most probably therefore killed north of the Columbia river. No specimen exactly like it has been lately obtained.

NORTHERN SHRIKE (*C. borealis*). I shot a specimen, the only one I saw, at Fort Dalles, October 15th,—early in the season for it to appear even in that latitude. It was savagely attacking Jays and Magpies, driving them before it, but it did not kill any birds while I observed it.

VIREO (*Vireo olivaceus? V. Bartramii* Swainson?). I found this species quite common from the eastern base of the Rocky Mountains to that of the Bitterroot Range, and in habits found it exactly like the eastern *olivaceus*. As it is larger than that mentioned by Swainson, his specimen was very probably, as Baird suggests, of the next species, especially since this is found unchanged at Fort Bridges, Utah.

WARBLING VIREO (*V. gilvus*). Rather less common than the preceding in the Rocky Mountains, though very common west of the Cascade Range. I noticed nothing new in its habits.—*To be continued.*

AN AFTERNOON IN NICARAGUA.

BY WILLIAM H. DALL.

WHEN the agent of the Central American Transit Company announced to us, that on account of the low water, we might be detained a day or two at Greytown, we did not consider ourselves unfortunate by any means. A collecting party was quickly organized, and, after partaking of fried plantains and "tortillas," with a cup of coffee from the hands of a señorita very much the color of the beverage just mentioned, each one started out prepared to make the best of the six hours of daylight remaining, by dispersing into the bushes in search of specimens of all kinds. Previous, how-

ever, to our departure, a person showed us a bottle of whiskey, which he asserted contained the most poisonous reptile extant. On examination it proved to be a specimen of a very beautiful snake, banded with red, black, white and cream-color, and of a genus (*Elaps? euryxanthus* Ken.) which is perfectly harmless. In vain we pointed out the jaws, totally destitute of fangs, and almost toothless, and were again assured that it was the far-famed "coral snake," of which the bite was inevitably followed by a bloody sweat, and death in most awful agonies. Not wishing to waste time in discussing the point, we separated, each striking into the heavy growth of bushes back of the town, or following the sandy beach to the entrance of the lagoon, now no longer a harbor.

I pushed into the jungle by a narrow foot-path winding among the trees, which, with the vines and even the grasses, appeared each one to vie with all others in the production of hooks, thorns and prickles. The mosquitoes, too, were by no means idle. The path soon brought me to the edge of a small lagoon, surrounded with trees and vines, and presenting a most beautiful scene. Here and there on the sunny side of a log, were small lizards with their sides brightly banded with metallic blue or green, chestnut and black. Everything was quiet, but a mellow humming told of insect life hovering among the green leaves.

The most noticeable among the many plants which were growing in the water, was a gigantic Sagittaria, rising above the water six or eight feet; its beautiful pointed leaves and white flowers bearing a great similarity to the common Arrow-head of the Massachusetts ponds. Rich crimson orchids were to be seen growing in the branches of the higher trees; but, after considerable exertion, having dislodged one of them, I was disappointed by finding it coarse and unattractive on a nearer inspection. Leaves of a nymphaceous plant, like our yellow pond-lily, but no flowers, were seen on the surface of the water.

The mosquitoes soon put an end to my pleasure in surveying the beauty of this secluded spot, and I made my way with some difficulty between the wild pineapples, which, bearing no edible fruit, add a positive evil to their deficiency of good, by pushing in every direction their sharp, saw-like, and inflexible leaves.

Reaching an open spot I saw a beautiful bird balancing himself on a slender twig, and occasionally uttering a plaintive note, of no great melody, but far from disagreeable, as is the case with many tropical birds. His body was a rich chestnut brown, and the underside of the tail of a bright golden hue. A lucky shot added him to my collection. It was the Inca Bird (*Ostenops Montezuma*); the "Oro-pendula" or Golden-tail of the Spaniards. Another moment and a flash of fire seemed to pass from one bough to another; my gun was brought into requisition again, and I brought down a fine male Fire Bird (*Ramphoceles passerina*), probably one of the most beautiful of American birds. The body is of the most brilliant scarlet, and the wings and tail jet glossy black. Others of our party obtained another species (*R. icteronata*) almost equally beautiful, where the most brilliant yellow on the rump and back takes the place of scarlet; while still another (*R. sanguinolenta*) glories in a dress of the richest velvety maroon.

It was growing rather dark in the dense thicket, and I retraced my steps towards the beach. On my way I added several other interesting birds (*Momoti*) to my collection, and one, a dark-colored, sad-looking bird, which proved the greatest prize of all, being a new species, afterwards described by Mr. Lawrence as *Spermophila badiiventris*. Reaching the edge of the wood, I found a small brook between me and the sand. The banks being low, were covered for several rods on the farther side, with a succulent plant of the order *Portulacaceæ*, with round leaves about half an inch in diameter. I noticed little well-beaten paths, about one inch wide, running all through this bed of green,

and stopped to discover if possible what made them. Some were wider than others, and on one of these I soon discovered a foraging party of ants. They were of two species, one being a rather small black ant, with weak jaws or nippers, and the other nearly twice that size, each bearing a formidable pair of prolonged mandibles or jaws, and as near as I could see there were no two with jaws of exactly the same size or shape. The small ones were evidently slaves. They were marched between two rows of scouts, and if a slave attempted to pass the line, he was speedily seized and put back, not very gently, into his place. I watched their motions with a great deal of interest. The "soldiers," after searching till satisfied for a rich succulent leaf, bit it off and gave it to a slave, who immediately marched off with it in a contrary direction to the main body. Following the train for a rod or two, I came to the brook just where it had made an abrupt bend, with an eddy in it. Here the banks were rather high, a moderately brisk sea-breeze was coming from the shore, and just here a small tree about two inches in diameter had fallen across the brook. On this pole were myriads of ants going in different directions. Those above, each with a leaf in his mouth, were crossing to the wooded side. Those on the underside were empty-handed (or mouthed), and were coming from the woods. Here I noticed a curious thing. The leaf, being larger by far than its bearer, acted as a sort of sail to catch the wind, and I saw many an unfortunate slave-ant, after struggling with all its might to save its precious load, finally let it go in self-defence, and immediately join the excursionists on the lower side of the pole, going back for another leaf. In the eddy before mentioned, there was at least a bushel of these leaves which had been blown away from their bearers.*

The red light of the setting sun warned me to be stirring homeward; and, picking up a few Apple-snails (*Ampullariæ*), I walked briskly towards town. Stopping for a moment to

* Probably a species of Œcodoma.—EDITORS.

turn over a bit of plank in search of land shells, to my great delight, there lay snugly coiled up, one of the famous "coral snakes!" Taking his head between my finger and thumb, I let him coil around my wrist, and made the best of my way to the office of the Railroad Survey, determined to prove the harmless nature of the pretty little creature. Upon producing it, however, two of my English friends disappeared through the window, and the one before mentioned reaching the loft over head, in a great hurry, seized an empty bottle (there were plenty of them there), and adjured me in forcible language to depart and take the snake with me, on pain of several things too disagreeable to mention. Doubting the efficacy of argument in the premises, I consigned the snake to an alcohol tank, and took the story to the supper table, where it afforded us a fund of amusement for the evening, and was by no means the most disagreeable reminiscence of my afternoon in Greytown.

REVIEWS.

TRAVELS IN THE EAST INDIAN ARCHIPELAGO.*—The object of Prof. Bickmore's travels was the collection of a set of shells from the island of Amboina and its immediate neighborhood. In this Mr. Bickmore seems to have fully succeeded, and thanks to his energy and perseverance, we now have in this country a full suite of the species first described by Rumphius. The present volume merely states this object and describes the mode of its attainment. Otherwise it is a diary of the author's daily experience among these tropical islands, in which mountains, lakes, rivers, plants and animals, incidents and accidents, are all described as they happened. The coast tribes are said to be of a mild disposition, but those of the interior mountainous parts of the different islands, wild and savage; in some cases cannibals. The ethnological characteristics of the different tribes are given whenever practicable, and the details of their dress, and habits of life sometimes accompanied by photographs and drawings of great value.

"All the natives (Malays, of Java) are remarkably short in stature, the

*Travels in the East Indian Archipelago. By Albert S. Bickmore, M. A. 8vo, pp. 553. Sent to us by H. A. Brown & Co., Boston.

men averaging not more than five feet three inches in height. The head is somewhat lozenge-shaped, the cheek bones high and prominent, the mouth wide and the nose short,—not flat as in negroes, or prominent as in Europeans." "The men have but a few straggling hairs for beards, and these they generally pull out with a pair of iron tweezers. The hair of the head in both sexes is lank, coarse, and worn long." The different kinds of trees and their fruits are graphically described, and the drawings which illustrate them are characteristic, especially that of the Bamboo. We have space to quote but one or two of the more interesting passages, since these travels extend to many islands, each of which are in turn described; while their political history, the character of their people, agriculture, and geological features of the countries, all pass in review. The author thus describes the different zones of vegetation in the island of Java: "Above one thousand feet, palms, bananas, and papilionaceous plants become fewer, and are replaced by the lofty fig or 'waringin,' which, with its high top and long branches, rivals the magnificent palms of the sea-shore." Liquid amber, and the cotton-wood, also appear, and orchidaceous plants and ferns in considerable numbers. "Over this region of the fig, comes that of oaks and laurels. Orchidaceous plants and melastomas are more abundant here." "Above six thousand feet are Rubiaceæ, heaths, and cone-bearing trees," succeeded by the zone of small ferns, lichens, and mosses.

Java is the Cuba of the East Indies. "In each there is a great central chain of mountains. Both shores of Cuba are opposite small bodies of water, and are continuously low and swampy for miles, but in Java only the north coast borders on a small sea. This shore is low, but the southern coast, on the margin of the wide Indian Ocean, is high and bold, in accordance with the rule that the higher elevations are opposite the greater oceans."

The islands of Lontar, Pulo Pisang, and Pulo Capal, are described as the remnants of the wall of a sunken crater, the length of which was four and a half, and the breadth not less than three and a half miles. The active volcano of Bromo, within the limits of this crater, was ascended and described, Mr. Bickmore nearly losing his life in the attempt. The grave of Rumphius, marked by a small square pillar, is still in existence, and was found and described by the author.

The many observations and facts which the author has brought together, would have been made more available, and more valuable to the scientist, if the work had been less diffuse. The number of pages might have been lessened without detracting from its popular character, or the freshness and beauty of many of the descriptions of the fruits and natural scenery.

Bee Keeping.*—In this pamphlet the author describes what he claims to be "a new system of bee keeping, adapted to the habits and characteristics of the honey bee; with descriptions of, and directions for mana-

* A New System of Bee Keeping. By D. L. Adair. Cincinnati, 1867. 8vo, pp. 74.

ging bees in the section bee-hive, embracing also improved methods of artificial swarming, whereby the business of bee keeping is rendered more profitable and pleasant." The rearing of bees is becoming a source of profit to farmers, and though without a practical acquaintance with the subject, we should judge it to be for the interest of every bee keeper to own this little manual, and to learn the merits of the section bee-hive described and figured in it.

THE EXTINCT FLORA OF NORTH AMERICA.* — This pamphlet is the climax of the late controversy between Messrs. Meek and Hayden on the one side, and Profs. Marcou and Heer on the other. This controversy made us acquainted with the fact that the familiar forms of the poplar, oak, sassafras, willow, etc., lived in the Cretaceous period; and in the present pamphlet the author, who was also one of the first to assert this truth, reviews the main points of the evidence, and brings forward a numerous list of new species. The Cretaceous period, though the continent had a different outline from the present, and though it was inhabited by animals very distinct from ours, had forests resembling in many of their characteristic trees those of to-day. "Salisburia, Sabal, and Cinnamomum, etc., are indicative of a warmer climate," and are found on the West coast of the continent. "Possibly these genera may hereafter be detected in the plant-beds of Kansas, Nebraska, and New Mexico, but as yet we have no intimation of their existence, and there is nothing now known in the Cretaceous flora of that region which gives it a tropical or even sub-tropical character."

"It will be remembered that this vegetation grew upon a broad continental surface, of which the central portion was considerably elevated. This would give us physical conditions not unlike those of the continent at the present day; and it would seem to be inevitable that the isothermal lines should be curved over the surface somewhat as at present. It may very well happen, therefore, that we shall find the palms and cinnamons restricted to the western margin of the Cretaceous continent. It will be seen by the notes now given of the Tertiary flora of our continent, that, at a later date, palms grew in the same region where these Cretaceous plants are found; but cinnamons and other tropical plants seem to be entirely wanting in the Tertiary flora of the central part of the continent, while on the west coast both palms and cinnamons lived during the Tertiary period as far north as the British line. We have therefore negative evidence from the facts, though it may be reversed at an early day by farther observations, that the climate of the interior of our continent during the Tertiary age was somewhat warmer than at the beginning of the Cretaceous period, and that during both the same relative differences of climate prevailed between the central and western portions that exist at the present day."

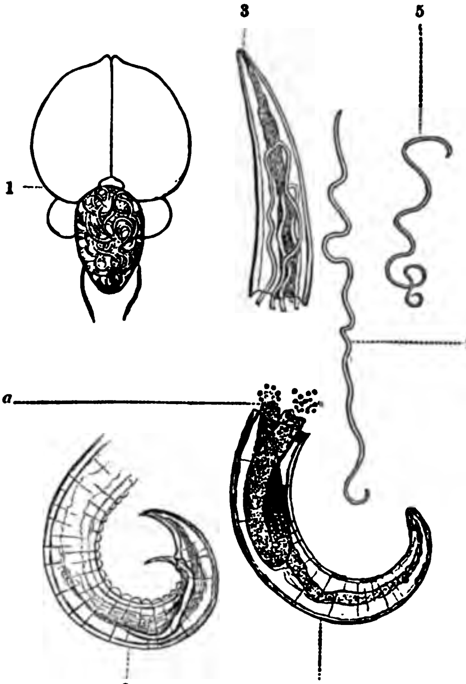
PARASITIC WORMS IN THE BRAIN OF A BIRD.†—One of the most obscure subjects in zoölogy is the history and development of animal parasites, and especially those which take up their abode in the brain of different animals. Prof. Wyman has detected a species of "round worm" in the brain of seventeen out of nineteen specimens of the *Anhinga* (Snake-bird

* Notes on the Later Extinct Floras of North America, with descriptions of some New Species of Fossil Plants from the Cretaceous and Tertiary Strata. By Prof. J. S. Newberry, of Columbia College, New York. 8vo, pp. 76.

† On a Thread-worm infesting the Brain of the Snake-bird." By Jeffries Wyman, M. D. (From the Proceedings of the Boston Society of Natural History, October 7, 1868). 8vo, pp. 7.

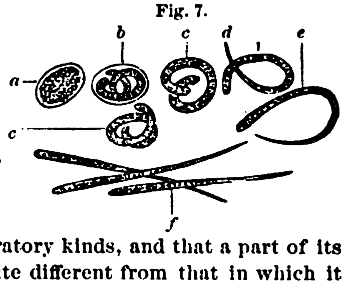
or Water-turkey) shot in Florida, thus proving that "their presence in the cranial cavity might be called the normal condition of this bird." The author states, that

"Parasites have occasionally been found infesting the brain or its membranes in man and animals, but far less frequently than in the other regions of the body. The number of species thus far observed is quite small, and are chiefly referable to the genera *Tænia*, *Filaria*, *Tri-china*, and *Diplostomum*, and confined almost wholly to man and domesticated animals, such as the sheep, reindeer, dromedary, horse and ox; and among wild animals to the chamois, roe-buck, and a few others. That they have not been more frequently seen in the wild species is without doubt due to the fact that the brains of these have been so seldom examined for the purpose of detecting them."



These worms, "which correspond very nearly, if not identical with the *Eustrongylus papillosus* Diesing," were found in every instance coiled up on the back of the cerebrellum (Fig. 1), their number varying from two to eight. Fig. 2 is the female, and Fig. 3 represents the head, much enlarged, and Fig. 4 the end of the body, showing the oviduct and eggs (*a*). The male, Fig. 5, is only one-half as thick as the female, and the end of its body, Fig. 6, is always more closely coiled than in the female. This worm is viviparous, the young hatching in the oviduct. The development of the young is sketched in Fig. 7; *a*, is the egg; in *b*, containing the embryo, which leaves the egg in the form indicated at *c*, *c′*. As they descend lower down in the oviduct, they straighten themselves, as at *d* and *e*, until they become of the form indicated at *f*. "Their earlier stages are unknown, but the analogy of the Gordiaceous, and other worms, lead to the supposition that the parasite of the brain of *Anhinga* is one of the migratory kinds, and that a part of its life, at least, is passed in a locality quite different from that in which it was detected. The manner in which the transfer of the embryo is effected

Fig. 7.



outwardly to some other animal, or the water, and then back to another *Anhinga*, is wholly unknown."

SCIENTIFIC OPINION.* — A weekly journal showing the progress of science in all its departments, is a most welcome publication. It is edited with great ability, and its editorial reviews deserve especial notice for their plain speaking and candor. No other journal known to us reports so promptly and fully the Proceedings of Scientific Societies, especially the German and French. Both this and the Paris *Cosmos*, a favorite exchange with us, will doubtless have a wide circulation in America, as science is attaining such proportions that we on this side of the water must receive weekly scientific intelligence from Europe.

FAUNA OF THE GULF-STREAM AT GREAT DEPTHS.† — This is the continuation of a similar paper by the same author previously reviewed. The utmost depth reached with the dredge was 517 fathoms, or 3102 feet, or over 1000 feet beyond the late researches near Spitzbergen. The bottom has been divided into three regions, extending in zones around the Florida reefs: — 1st, From the reef outwards four or five miles to the depth of 90 fathoms; 2d, From 90 to 250 or 350 fathoms; 3d, The bottom of the channel which does not much exceed 500 fathoms. The first region is barren, and covered only by dead and broken shells, showing that the fauna of the reef itself does not extend seaward. The second is "rich in animal forms," and is particularly interesting to the geologist. It is a limestone, gradually increasing by the accumulation of the calcareous remains of Corals, Echinoderms and Mollusks. "These debris are consolidated by the tubes of Serpulæ, the interstices filled up by Foraminiferæ, and smoothed over by the Nullipores. It is supposed by the author that this will eventually thicken until the water is shallow enough for the Astreans and Madrepores to begin their work of founding a new barrier similar to the existing reefs. This limestone is filled with recent fossils, furnished in great part by the animals now living on the bottom, but "a few contribute by sinking after death from the higher regions of the superincumbent water (teeth of fishes and shells of Pteropods), and others are brought by currents from littoral regiòns (bones of the Manatee, and fragments of littoral plants). All the branches of the animal kingdom, so far as their marine carnivorous orders are concerned, are abundantly represented in this region, but it is destitute of plants.

The third region is sparsely inhabited by a few Mollusks, Radiates, and Crustaceans, but the peculiar animal is the microscopical Globigerinæ whose siliceous shells have covered the bottom of the channel with a thick deposit. The deep sea animals of the second and third regions are of smaller size than allied forms of the littoral zone. "The only exception is an Echinus, which is nearly of the average size, and an Actinia.

*Scientific Opinion. A Weekly Record of Scientific Progress at Home and Abroad. Part I. December; II. January, 1869. 4to. Monthly Parts, 1s. 6d. London, 1869. 4to, 3 columns.

†Bulletin of the Museum of Comparative Zoology, No. 7. Contributions to the Fauna of the Gulf-stream at great depths. (Second series.) By L. F. Pourtales, Ass't U. S. Coast Survey.

The prevailing colors are white, pink,—sometimes playing into orange,—and a pale green. Blue was only seen in a small incrusting sponge. What proportion of light reaches a certain depth we shall try to determine during our next explorations. It is certain, however, that the deep sea animals have generally well-developed eyes, larger if anything than those of their congeners of shallow water."

THE GEOLOGICAL SURVEY OF ILLINOIS.*—Prof. Worthen announces that the Carboniferous system attains a maximum of 2500 feet in this State, and contains ten seams of coal, six of them in the lower, three hundred feet of the true coal measures being of workable thickness. The whole series is exposed in the banks of the Illinois, which cuts diagonally across these beds for more than a hundred miles from north-east to south-west.

Prof. Worthen points out from theoretical data what may possibly prove to be a very serious mistake in Prof. Owen's estimate of the thickness of the coal measures in Kentucky. If it prove a true criticism, Kentucky is not so rich by one half in workable coal seams as she has been represented. Prof. Worthen thinks that Prof. Owen mistook two outcroppings of the same sandstone for two different layers, and that these two, which are distinguished as the "Anvil-rock Sandstones," and the "Mahoning Sandstone," in the Kentucky section, are identical. If this be so, the series of coal seams between the latter and the former, do not overlie the Mahoning Sandstone, but are merely similar or duplicate beds, occurring in the same geological horizon. "The product of our coal mines for the past year (1867) according to the most reliable statistics, is fully 1500000 tons." "There is, perhaps, no other area of equal extent in the United States where coal is so easily obtained with a moderate expenditure of capital as in the Illinois Coal-field." The strata are undisturbed; their inclination from the western border to Springfield is not over seven feet to the mile, and the principal seams are accessible in the central parts of the State, at from two hundred to four hundred feet. Our space only permits us to name the counties, the geology of which is fully described. They are Alexander, Union, Jackson, Perry, Jersey, Greene, Scott, Washington, Clinton, Marion, Jefferson, Cook, and La Salle Counties.

The second part, by Messrs. Meek and Worthen, is devoted to Palæontology, and contains among much interesting matter, full descriptions and figures of the remarkable Carboniferous crustaceans from Mazon Creek, which were first made known by this survey. Mr. Scudder describes the fossil insects, and gives many interesting details. From these it appears that we have from the Grundy County Carboniferous rocks, besides those described in Vol. I, one species of Eurypterus and two Crustaceans allied to the common Limulus; two Isopods, and two Macrurous Decapods. Among insects there are two Myriapods, one of enormous size, two species of Neuroptera belonging to two genera, and two species

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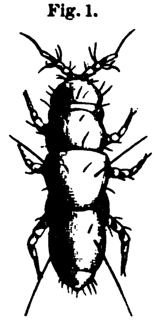
* Geological Survey of Illinois. A. H. Worthen, Director. Vol. III, Geology and Palæontology. 4to, pp. 574. With twenty plates and numerous illustrations.

allied to the Scorpions, and one whose affinity is doubtful. The species formerly described and figured as a caterpillar in Vol. II, page 163 of the NATURALIST, is now thought, from the study of additional specimens, to be a worm, the hairs on the body being longitudinally striated, and, according to Dr. Packard, resembling those of Aphrodite.

THE ANCESTRY OF INSECTS; FOSSIL INSECTS AND CRABS, IN ILLINOIS.* —Prof. Haeckel, of Jena, has been speculating as to the ancestors of the articulates. He considers the ancestral form of the crustacea as a zoëa-like creature, resembling the larval or zoëa-stage of the crab. As to the ancestor of the air-breathing, terrestrial articulates (insects, spiders and centipedes), he proposes the theory that it was a zoëa which, probably, about the Devonian Period, adopted a terrestrial life. As this is an age of speculation, we should suggest, that the ancestors of the insects (including the six-footed insects, spiders and myriapods) must have been worm-like and aquatic, and when the type became terrestrial we (still speculating) would imagine a form somewhat like the young Pauropus (Fig. 1) discovered by Sir John Lubbock in England, which combines in a remarkable degree the characters of the myriapods and the degraded wingless insects, such as Smynthurus, Podura, etc. Some such forms may have been introduced late in the Silurian period, for the interesting discoveries of fossil insects in the Devonian of New Brunswick, by Messrs. Hartt and Scudder, and those discovered in the lower part of the Coal Measures, at Morris, Illinois, and described by Messrs. Meek, Worthen and Scudder, reveal carboniferous myriapods, *Euphorberia* (two species), more highly organized than Pauropus, and a carboniferous scorpion (Buthus?), closely resembling a species now living in California; together with another scorpion-like animal, *Mazonia Woodiana;* while the Devonian insects described from St. John, by Mr. Scudder, are nearly as highly organized as our grasshoppers and May-flies. Dr. Dawson has also discovered a well developed milleped (*Xylobius*) in the Lower Coal Measures of Nova Scotia; so that we must go back to the Silurian period in our search for the earliest ancestor, or (if not of Darwinian proclivities) prototype, of insects. As to the earliest Crustacean being a zoëa-form, have we not among the earliest known Crustaceans, the Trilobite (*Paradoxides*) and several allied forms of Lowest Silurian age, whose larval form was, undoubtedly, more or less worm-like, as are certain degraded marine Pill-bugs (*Bopyrus*) of the present day? Messrs. Meek and Worthen describe fossil Shrimps (*Anthropalæmon*) and Sand-fleas, in the Lower Coal Measures of Illinois, associated with a large Eurypterus, being a gigantic shrimp-like animal; a Trilobite (*Euproops Danæ*) resembling our

Fig. 1.



*The Palæontology of Illinois. Articulate Fossils of the Coal Measures. (Advance sheets of the Report of the Illinois State Survey.) By Messrs. Meek, Worthen and Scudder. September, 1868. 8vo.

Horse-shoe Crab; and several insects are described by Mr. Scudder under the name of *Miamia Danæ*, and *Chestoles lapidea* (a neuropterous insect allied to Miamia); also part of a Cockroach, and a Harvest-man or Daddy-long-legs, allied to, but lower than the spiders, with several other undetermined remains of insects. With such recent discoveries of so highly organized articulate life in rocks so ancient, and with the late discovery of a land-plant in the lower Silurian rocks of Sweden, it seems premature to even guess as to the ancestry of either these or their living representatives.

THE BOOK OF BIRDS AND THE BOOK OF BEASTS.* — From an examination of their contents we do not hesitate to say that they form a valuable addition to our popular-science literature. The engravings are numerous and well done. The subject is treated in a clear and interesting manner, and with the typography and binding, form elegant volumes for the young.

CECIL'S BOOK OF INSECTS.† — A very pleasantly written book, containing chapters about Ants, Bees, Spiders, Dragon-flies, Wasps, Locusts, Mosquitoes, Beetles and Butterflies. The illustrations are as a whole very good, and the stories about insects are reliable and well calculated to interest the young, and induce them to observe the habits of insects and form collections of them.

LIST OF THE LEPIDOPTERA OF NORTH AMERICA.‡ — The American Entomological Society, which has issued six volumes of Proceedings, and has entered on the second volume of Transactions, all beautifully illustrated, and indispensable to the study of our insects, and we may add, published remarkably cheap, is now issuing, in Parts, a list of our Butterflies and Moths, by Messrs. Grote and Robinson. The present Part embraces the species of Sphinges, Ægerians, the Thyridæ, Zygænidæ, and the Bombycids, or Silk-worm family, found north of Mexico. The catalogue gives the most important synonyms, and when finished, will be an invaluable book of reference to students of this group of insects.

We should here speak of the remarkable energy shown by the members of this young society, which was incorporated in 1862. With but a single salaried officer it started at once under very adverse circumstances, and established a printing office in its own hall, and issued annually a volume of Proceedings, rivalling in interest and value those published by the Entomological Societies of London, Paris, Berlin and Vienna. Not content with this, its members edited "The Practical Entomologist," designed to acquaint farmers with the habits of the injurious insects, distributing from 5000 to 8000 copies each month, gratuitously the first year, and for a mere trifle the second, when it was obliged to suspend its

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* Cecil's Books of Natural History; Cecil's Book of Beasts; Cecil's Book of Birds. By Selim H. Peabody, M. A. Chicago: Clarke & Co. 12mo.

† Cecil's Book of Insects. By Selim H. Peabody, M. A. Chicago: Clark & Co., 1868. With eleven full-page illustrations. 12mo, pp. 228.

‡ List of the Lepidoptera of North America. By A. R. Grote and C. T. Robinson. Part I. Philadelphia: American Entomological Society. September, 1868. 8vo, pp. 16.

publications for want of means. The Society in a circular recently issued, asks the pecuniary aid of all interested in science. We hope that the citizens of Philadelphia, who have already done so much for science, will not let one of its most useful institutions of learning suffer for want of the funds asked for in the present circular, for the society seeks for a mere pittance, such as a few of the wealthy men of that well-to-do city could easily grant. We hope all our entomologists will lend their aid to a society which has done so much for the furtherance of their favorite study, at least by subscribing to its Transactions, which are published at $3 a year.

CATALOGUE OF NORTH AMERICAN GRASSHOPPERS.* — A very carefully prepared list of all the Orthoptera of our country. The author states in the preface that the arrangement, both of genera and species, is a purely alphabetical one. "The list is not in any sense a synonymical one, involving the expression of personal views, but a hand-book for the student, in which is collected every reference to any species of orthoptera stated to have been found on the continent of North America, or in the West Indies, — a groundwork upon which he may erect a superstructure of his own." Mr. Scudder is also preparing a monograph of the orthoptera for publication by the Smithsonian Institution, and desires specimens of this neglected group of insects. A new arrangement of the families, and a more natural one than has been offered before, is appended.

THE PROGRESS OF ZOÖLOGY IN 1867.† — To the American student these yearly volumes are an indispensable aid. They contain lists of every paper or work relating to zoölogy, with a brief analysis of their contents. How any working naturalist, without a large library at hand, such as scarcely one institution in this country affords, can do without these reports, we do not see. "The fourth volume of the Record forms a systematic guide-book to about 36,400 pages of the zoölogical literature published (with the exception of a very small part) within the year 1867. This number has never been reached in any preceding year, and corresponds to an increase in the number of authors; an unusually great activity appears to have prevailed in the study of Mammals, Birds, Mollusks, Neuroptera and Orthoptera."

The publisher, Mr. Van Voorst, deserves the thanks of zoölogists the world over, for the liberal spirit he has manifested in undertaking the publication of a work which he prints at a considerable pecuniary sacrifice. The British Association, however, made a grant of $500 for the present volume and the succeeding one. The volume is issued in three parts, viz.: that of Vertebrates, of Entomology, and of Mollusks; Crustaceans and Lower Animals, so that the specialist can at a cheap rate supply himself with a report on his own branch.

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* Catalogue of the Orthoptera of North America, described previous to 1867. Prepared for the Smithsonian Institution by Samuel H. Scudder. Washington: Smithsonian Institution, Oct., 1868. 8vo, pp. 89.

† The Record of Zoological Literature, 1867. Vol. IV. Edited by A. C. L. G. Gunther, M. D., etc. London: Van Voorst. 1868. 8vo, pp. 678. The volume, or the separate parts, can be furnished by the "American Naturalist Book Agency."

NATURAL HISTORY MISCELLANY.

BOTANY.

DOUBLE FLOWERED SARRACENIA.—In the summer of 1867, I found a specimen of the *Sarracenia purpurea*, double, in East Hampton, Mass. In the summer of 1868, I found a specimen of the *Geranium maculatum*, with all the parts of the flower of a pure white.—E. S. MILLER, *Wading River, N. Y.*

ZOÖLOGY.

THE BREEDING HABITS OF BIRDS are subject to so great variations, that it is not safe to give the practices of a few individuals as being the general habits of the species. Any one who has given much attention to the subject, must be convinced of this, both from his own experience and that of others who have written upon the subject. And there can be no doubt that the apparent discrepancies of writers are frequently the result of founding conclusions upon insufficient data. Take the Kingfisher as an example. In a number of cases which have come under my observation, the passages leading to the nests were invariably straight, so that there was no difficulty in reaching the extremity of the excavation with a straight stick. This agrees with Dr. Wood's experience as given in the September number of the NATURALIST. Mr. Samuels, in his "Birds of New England," says they excavate a "winding hole." Mr. Fowler and Mr. Endicott, in the NATURALIST, describe them as being "in the form of an elbow." But while all these descriptions are doubtless correct, is it correct to state in general terms that the passage is in the form of an elbow, thus implying that this is the invariable, or even general form? One of the nests which I have found had the bottom covered with fish bones, the ejected pellets of the bird, and upon these the eggs were laid.

I have in my collection a set of Long-eared Owls' eggs, six in number. I have not been fortunate enough to find another nest, but should I represent this species as usually laying six eggs, I should probably convey a wrong impression.

While visiting a heronry last spring, on one of the low islands off the coast of Cape Charles, Va., I found a nest of the Clapper-rail (*Rallus crepitans*) built in a bush, and about a foot from the ground. I have seen many nests of this species, but that is the only instance in which I have known the bird to nest elsewhere than on the ground. The land was low and wet, and liable to inundation, which was the probable cause of the bird's departure from the usual habit of the species.

In an article by Mr. Fowler in the September number of the NATURALIST, I find the eggs of the Ruffed Grouse thus described: "The color of

the eggs is yellowish-white, marked with reddish brown spots. Usually the last ones of the litter are without spots, and of a lighter color; a few larger round spots appear to be laid on the surface of the shell and raised above it." To this I would say that I have seen a great many eggs of the grouse, but only a few were marked as thus described. And while the description is true to a certain extent, it may be questioned whether it is applicable to "typical specimens." On the 29th of April, 1865, I found a nest of the grouse, containing nine eggs of a pure white color, with the exception of a few stains, which were soon removed by the application of soap and water. After a time the color changed to a brownish white.

On the 3d of May, 1866, I took three eggs from the nest of a Marsh-hawk. There was no appearance of spots upon them. As I had seen the birds about the place for two weeks, selecting a spot and building their nest, I feel sure that this was the first litter. But last spring I obtained six eggs from a nest, and all were marked with numerous light brown spots and blotches. The same nest was occupied two years previous, thus proving that the marsh-hawk does sometimes occupy an old nest.—C. M. Jones.

The House Wren.—The mischievousness of the House Wren (*Troglodytes ædon* Verrill) is well known. The following incident came under my observation a short time since. A pair of Martins had taken possession of a box that I had erected in the garden for their benefit; had built their nest, laid their eggs, and had commenced setting, when a pair of house wrens, who coveted their neighbor's house, entered it in the absence of the martins, and coolly picked up their eggs one by one, carried them out, and dropped them to the ground below. While engaged in this impudent business, the martins returned, and while going in at one of the entrances of the box, the daring marauders darted out at the other, and alighting on a tree near by chattered noisily, apparently in great glee. The martins, finding that their nest had been despoiled, abandoned the box, which was then duly taken possession of by the wrens, who reared two broods of young hopefuls during the summer, the first about the beginning of June, the second the latter part of July.—M. S. Hill, *East Liverpool, O.*

Destructiveness of the Larva of the Goldsmith Beetle.—In previous numbers of the Naturalist, I ventured the opinion that the Goldsmith Beetle (*Cotalpa lanigera*) was not likely ever to prove a serious pest to the agriculturist. As respects the insect in its beetle state, perhaps this may prove correct; but so far as that opinion may have related to the larva of this insect it must be retracted, as a positive observation lately made must settle this matter forever.

When on a visit in September last to the farm of a celebrated strawberry grower, in Monmouth County, N. J., my attention was directed to certain large patches badly thinned out by, as the phrase went, "the worm." The plants were dead on the surface and easily pulled up, the roots being eaten off below. It was observable that the fields which pre-

sented the worst appearance were all of the same kind of plant; that known as Wilson's Albany Seedling. Besides this there were nine other varieties under culture: Barne's Mammoth, Schanck's Excelsior, the Agriculturist, Triomphe de Gand, Cutter's Seedling, the Jucunda, Pine Apple, Early Scarlet, and Brooklyn Scarlet. While the Wilson stood second to none of these as a prolific fruit-bearer, yet it fell behind them in vigorous plant growth. Hence, while every kind was more or less affected, the other varieties seemed saved by their own growth and energy from a destruction so thorough as was that of the Wilson. These patches were all planted in the spring, and all received the same treatment, the ground being kept open and free from weeds. The amount of the spring planting was seven and a half acres. Of the Wilson's there were three different patches, in places quite separated from each other, and on not less than five different kinds of soil. These patches were among and contiguous to those of the other varieties. While all suffered more or less, the chief injury befell the Wilson's, of which not less than two acres were irretrievably ruined.

An examination turned up the depredator, who was none other than the larva of the Goldsmith Beetle, now engaged in the first one of its allotted three summer campaigns of mischief. These grubs were from the eggs deposited in June, in the well tilled and clean soil, which, I have said elsewhere, I thought the *Cotalpa* preferred to meadow or grass lands. Compared to others, the larva of this beetle is sluggish and easily captured. The black grub of the spring, which is such a pest, attacking almost indiscriminately the early tender plants, inflicts its injuries chiefly in the night, the exception being that of dull and cloudy days. The night's mischief done it descends into concealment at early dawn. Knowing this the wise farmer is in search of it at an early hour, ere the warmth of the sun gives it warning to retreat. But the Goldsmith grub can be taken at any hour of the day simply by scratching away the earth from around the roots of those plants whose dark shrivelled leaves tell of the enemy's presence. It is my belief that this devastation might have been spared by an outlay of from $20 to $30 for labor, of which, under proper direction, much could have been done by children. Therein would have been saved a strawberry crop for the ensuing summer, worth scarcely less than $2500 for, from this same farm the crop of a single acre has been sold for $1500; Then, however valuable such labors are in immediate results, that is but a fraction of their worth as respects the future. These Cotalpa grubs, with all their mischief, had not more than a third of their ultimate size; hence their real ravenousness is yet to come. Besides what a prospect of increase of numbers, should even a moderate share of them reach maturity? Why should not our farmers seek to know something about their insect enemies, and when practicable put forth some energy to meet them as such?—Rev. S. Lockwood.

The Lycosa Spider and its Young.—On the 27th of June I saw a spider descending the trunk of a tree. At a distance of six feet it ap-

peared the size of a pigeon's egg. As soon as it observed me it stopped. Approaching it gradually I could see it crouch, evidently aware that it was noticed. I sharpened a long stick and stuck a pin through the end, and made a strike to empale the body and missed it. What was my astonishment when I beheld a mass of life *uniformly distributed* over the spider; it was all alive. I knocked the spider from the tree to a flat rock beneath; the jar seemed to shake from its abdomen what I soon saw were young spiders, as the rock was *black* with the young ones for a space of six inches in diameter around the old spider. The parent spider did not attempt to run but crouched, and the young began to gather upon her body again. I made a successful hit, and stuck the pin where it held, and the moment it was inserted into the spider's body, the young left at once and dispersed upon the rock. I soon perceived the floating webs passing from the rock to spears of grass on which spiders were quite thick. I should say, at a pure guess, that there were two hundred young spiders, but from the long legs they spread out, they seemed even more numerous. I next noticed spiders upon my coat, hat and collar, and experimented myself with the spider throwing out the floating web. When about six to ten feet from the rock, I saw in the sunlight two webs floating aside of each other, about one foot apart. I saw that the terminus of these webs were but a short distance from my face, and at each end a spider. They moved slowly before the wind, and I watched them for several feet, mounting upwards until lost to view.—G. W. PECK.

[Several species of the genus *Lycosa* are known to have the habit of carrying their young about with them.—EDS.]

THE CATTLE TICK.—The perfect insect found in Texas, gorged with blood and ready to give birth to its young, is much like Fig. 1 *e* of the Moose Tick (NATURALIST, Vol. II, p. 559). They drop from the cattle in the woods, and more frequently along the cattle paths. How long before they appear as "seed ticks" I do not know. It was a prevalent notion among the people that they burst open, nearly the whole interior being composed of the young. These, probably, soon after birth, ascend to the tip of the nearest twig or culm of grass, where they form into a little mass, with their legs extended ready to seize upon any passing animal. When taken off by one they soon commence operations, and in three or four days, I should think, gorge themselves and fall off. They are then, except as to size, much like the full-grown gorged insect. How long a time is required for them to become depleted, or to regain their flattened form, I do not know; but when ready for a new meal or a new transformation (now called "yearling ticks"), they again ascend bushes, but not in clusters; or they crawl over fallen leaves and attach themselves again to animals as chance may offer. They again gorge themselves and fall off as before, to become lean a second time. A third time they fasten to horses, cattle, hogs, dogs, man, and other animals. This seems to be their last time, and, when full, they fall off and become converted to *seed* ticks. This was the common belief, and may be more or less erroneous or defective.

In Cuba I started from St. Jago, with two horses, to go to Havana. Before I had travelled half the journey one of the horses became infested with ticks, the other had none or few. Every day while resting at noon, with a knife I scraped off all the ticks I could see or feel. Notwithstanding all my efforts, the ticks gained upon me so far as regards the horse, but none attached themselves to my person, though I camped most of the nights during the journey, sleeping on the same spots upon which the horses fed. Around the larger ticks were generally found one or more small ones, sometimes many of the latter. I have seen something of the kind in the coast prairies of Texas. Are they viviparous? I never observed anything of the kind in the woodland districts of Texas, and the above mentioned ticks of Cuba were those of the savanna rather than of the timbered parts.—CHARLES WRIGHT.

SUBSTITUTES FOR POLLEN FOR HONEY BEES.—My bees carry into their hives from one hundred to one hundred and fifty pounds of rye meal every spring, during the occurrence of a few warm days before flowers appear. After their appearing in an abundance, the bees will no longer take up the meal. As a consequence of this early and free supply of a material for bee-bread, the queen is stimulated to unusual activity in depositing her eggs, and strong swarms are ready to come out on the bleak shores of Lake Erie by the middle of May,—an occurrence often happening with me since I began to thus feed them, in 1860, but not happening when the meal is withheld. Unbolted rye flour, and also ground linseed or oil-cake may be substituted, but the best rye meal is preferred by the bees, and is perhaps the cheapest. A handful of clean straw should be placed in an open box, standing in the middle of the apiary, and the meal should be scattered over the straw; otherwise many of the bees will get fatally swamped in the meal.—J. P. KIRTLAND, *East Rockport, O.*

HIVE BEES DEVOURED BY HORNETS.—The Paper Hornet (*Vespa maculata*) often enters my nucleus hives, when I am rearing Italian queen bees, and captures the young queen in the midst of her little colony; usually just after she has commenced her first laying. I have seen this depredator enter the small hive, drag out the queen, and fly away with her to the woods.—JARED P. KIRTLAND.

VARIATION IN THE SKELETONS OF WHALES.—M. Van Bambeke has been studying the skeletons of whales, and finds greater variation among them than cetologists seem to believe. The symmetry of the head is rarely complete, since the two sides are generally unlike. There are greater individual differences than usual in other vertebrate animals, and a great number of individuals are necessary for the establishment of species. There are, however, some naturalists for whom any modification, however small it may be, suffices for the creation of new species. The *Tursio* described by M. Van Bambeke, has thirteen ribs on one side, and fourteen on the other, like the skeleton of the Mysticetus, at Brussels. In another Tursio, of Heligoland, Van Beneden has found thirteen, and in a skeleton of the Mediterranean one, he counted only twelve. Van Beneden

has seen a Globiceps with ten ribs, and another with eleven; a Narwhale with eleven ribs, and another with twelve; and some "Killers" (*Orcus*) with twelve, thirteen or fourteen ribs. As to the number of vertebræ, it is true that they do not vary with age, but they vary in number in the same species. The *Balænoptera rostrata* Fabr., so remarkable for its forty-eight vertebræ, sometimes has forty-nine, and he has seen at Bergen, a skeleton of a male and of a female, both from the coast of Norway, of which one had only forty-five vertebræ, and the other forty-nine. Mr. Flower has counted fifty, and Lacépède has mentioned forty-six as occurring in the same species. — *Cosmos.*

EGGS OF YAMA MAI SILK-WORM FOR SALE.—I have received from England, *on sale*, a number of eggs of *Attacus Yama mai*, which I am now ready to deliver. The price of *Yama mai* eggs is ten for 30 cents, or thirty-five for $1. Picked eggs direct from Japan.—W. V. ANDREWS, 136 *Charlton street, New York.*

TRANSPORTATION OF LIVING FISH FROM SOUTH OF THE EQUATOR TO EUROPE.—Mr. Moore has succeeded in importing into Liverpool from the River Plata, the first living fish (a fresh-water Cyprinoid) that has been received from the south of the Equator. Dr. E. P. Wright has also brought to Paris living specimens of the only fresh-water Cyprinoid of the Secheylles Islands— *Scientific Opinion*, December.

DEEP SEA DREDGING.—Dr. E. P. Wright has dredged in 480 fathoms, off the coast of Portugal, living specimens of the Glass Sponge (*Hyalonema Lusitanicum*). Until first discovered by Prof. Bocaga, of Lisbon, it had only been known from Japan.

At this great depth, also, lives a shark (*Centroscymnus cœlolepis* Bocage & Cap.), a small fish (*Chiasmodon niger* Johnson), and an Isis-like coral (*Keratoisis Grayii* Wright).—*Annals and Magazine of Natural History*, December, 1868.

MARSUPIAL DOGS.—Of all mammals there is perhaps not one existing which is so truly interesting, so deeply significant of the history of the development and geographical distribution of mammals, as the marsupial dog. There are two Tasmanian species of this genus, *Thylacinus*, one of which is called the greyhound, and the other the bull-dog tiger.—*Quarterly Journal of Science*, January, 1869.

THE BELTED KINGFISHER AGAIN.—I notice in the NATURALIST so many conflicting statements relative to the nesting of the Belted Kingfisher, that I feel prompted to add my own observations upon the breeding of this well known bird. In Southern Illinois the Kingfisher is resident, and usually begins incubation about the middle of April. I have found numerous nests, all similarly located, viz., in the bank of some stream, or ravine, frequently far from any stream affording it a supply of food. On one occasion I found its excavation in the cut of a railroad, at least a mile from the river. The excavations that I have found varied in length from three to as much as nine feet, but more generally

about six feet. Frequently the excavation makes a rather abrupt bend, in the form of an elbow, but I have often found it straight to the end. I believe the termination is a little higher than the entrance. The "nest was always in a sort of oven-shaped chamber, near the end, the bottom being a little lower than the floor of the tunnel." I have never found any elaborate nest, the eggs in a majority of cases lying on the bare earth. On two occasions, however, I have found a bed of broken fragments of craw-fish shells, and fish-bones; but never to my knowledge any sticks or straws, or, indeed, feathers except those from the body of the owner. I have never found the bird sitting on less than six, or more than seven eggs, and I do not believe the number ever exceeds the latter. Both sexes incubate, as I have caught both male and female upon the eggs.—ROBERT RIDGEWAY.

GEOLOGY.

KJŒKKENMŒDDINGS IN IOWA.—In November last, Mr. J. J. Kinersly of Keosauqua called my attention to some aboriginal relics he had discovered upon the bank of the Des Moines River, near that place, while the workmen were cutting the bank for a road to a newly established ferry, and digging a hole for the post which supports the ferry-rope. In digging this hole they passed about four feet through a layer of silt-like earth, crowded with the shells of Unios, before they reached the original surface. These shells are of the same species that now inhabit the stream, among which were recognized *Unio plicatus*, *U. rectus*, *U. metanevra*, *U. crassus*, etc. The locality is just above the mouth of a small creek, which has cut into the accumulation by the shifting of its channel, and leaves it without that symmetry of outline it would doubtless have possessed if it had not been disturbed. The heap is not above the reach of the highest floods of the river, and has evidently been largely composed of the silt brought down by the river and creek at the times of high-water. Mingled with and composing a large part of its bulk, are the shells which were brought from the bed of the river when the water was low—the only time they are accessible—and the mollusks were evidently cooked and eaten upon this spot during many years. The bed of the river opposite this spot is broad and gravelly, and an excellent habitat for the mollusks, while both above and below the bottom of the river is not so favorable for their growth.

No other shells besides Unios were found, although a few others may yet be discovered. Very few other kinds are to be found in the river near there. The bones of the deer are common among the shells, the marrow bones always being split open. Pieces of the carapace and other bones of the fresh-water turtle were also found. Among the implements found by the slight excavation mentioned, are one hatchet of greenish hornblendic rock, some flint arrow-heads and sharp-edged flints, probably used for skinning animals, and fragments of crude pottery. Some fragments of the latter bear evidence of having been burnt in contact with

organic matter, and were probably broken and spoiled while being used for cooking purposes. Fragments of charcoal were frequently found scattered through the mass.

The pottery is composed of common clayey earth intermixed with sand and slightly baked; some of the surfaces are rudely ornamented by cancellated scratches, and some are marked as if they had been enclosed while soft in a loose fabric or netting, probably of twisted bark fibres, the twist of the thread being easily distinguished.

The examination of this interesting accumulation has been very slight, but it is proposed to resume it next season.—C. A. WHITE.

RHEUMATISM IN PREHISTORIC TIMES.—At the last meeting of the Pathological Society of London, Mr. Bush exhibited some specimens of pathological fossils. He exhibited a bone of a fossil rhinoceros which had been afflicted with rheumatism. He also exhibited a bone of a cave-bear, with a consolidated fracture, which had been broken just before the animal had hibernated; and another bone, of the same species of bear, which had been the seat of an osseous tumor.—*Cosmos.*

Disease also appeared among the reptiles of the Cretaceous formation of New Jersey, for Prof. E. D. Cope writes us: "I have just discovered a remarkable ally of Mosasaurus, which has a permanent functional dislocation of the ramus of the mandible. It has an articulation behind the middle, which has lateral and some vertical motion."

Disease is more common among the lower animals than is usually supposed. Prof. J. Leidy has exhibited to the Philadelphia Academy of Natural Sciences, pus globules from an abscess in the muscle of an oyster. —EDITORS.

FOSSIL PLANTS FROM GREENLAND.—Mr. Whymper has brought from the tertiary formation in Greenland, 137 species, of which forty-six are common to the European deposits of the Miocene Tertiary. Among the specimens are the cones of the magnolia, and the flowers and fruit of the chestnut.—*Cosmos.*

THE EARLIEST PLANT.—The discovery of Eozoön in the Laurentian rocks of Canada was of great interest. One of the most important discoveries recently made in palæontological science is analogous with it. It is the detection of what appears to be the remains of a terrestrial flora in certain Swedish rocks of Lower Cambrian age,—the supposed equivalents of our Longmynd rocks. A peculiar interest attaches to this discovery, inasmuch as it carries back the appearance of terrestrial vegetation upon the earth's surface through a vast interval of time, no land-plants having previously been known older than the Upper Ludlow beds. The Swedish fossils now discovered appear to be the stems and long parallel-veined leaves of monocotyledonous plants, somewhat allied to the grasses and rushes of the present day. These plants apparently grew on the margin of shallow waters, and were buried in sand and silt, although it is probable that several species, and even genera, may occur in the sandstone blocks which have been examined. They are provisionally in-

cluded in a single species, to which the name of *Eophyton Linnæanum* has been given. Eophyton, therefore, stands by the side of Eozoön,—the one being, in the present state of our knowledge, the earliest land-plant, as the other is the earliest animal organism.—*Quarterly Journal of Science.*

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

HISTORICAL SOCIETY OF PASSAIC, N. J.—This active society was organized March 28th, 1867, and held its first field meeting July 15th, 1868, when glacial marks were discovered upon the rocks near Little Falls, running in a south-easterly direction.

ANSWERS TO CORRESPONDENTS.

J. H. B., Camp Grant, near Richmond, Va.—The smaller of your plants is *Selaginella apus*. The larger is *Hypnum tamariscinum*. Both are found widely distributed through the United States.—J. L. R.

C. G. A., Augusta, Me.—Your insect boxes should be made as near air-tight as possible to be insect proof. The cover should shut down upon an inner shoulder, so that an invading insect will have to make four turns in order to get fairly inside the box. The inside should be daubed with creosote; or camphor, wrapped in paper with pin holes, should be pinned to the bottom of the box.

S. P. M., Cold Springs, N. Y.—Agassiz's "Methods of Study" is a good introductory Book for beginners in Zoölogy, and may be read with Tenney's "Zoölogy for Schools," Clark's "Mind in Nature," and Agassiz and Gould's "Principles of Zoölogy."

W. H. E., Coalburgh, W. Va.—The worm enclosed, which is two feet long, and the largest one we ever saw, is a gigantic Hair-worm (*Gordius*). Compare the account of the Gordius-like worm on p. 41. Also see Vol. I, p. 556.

D. M., Hamilton, Ohio.—The specimens are the "Basket-worm, or larva of the *Thyridopteryx ephemeræformis*, and will probably disclose the moth next spring. It feeds on different species of evergreens, and also on other plants, including the cotton.

F. P., Indianapolis, Ind.—The fern is *Aspidium achrostichoides* (a barren frond). It is common on shaded hillsides in the Northern States. We shall be pleased to get *good* specimens of the aquatic plants which we will have named for you. Send the set under numbers corresponding to those on the specimens you keep.

O C. M., New Haven, and others.—Your papers for the Proceedings of the Chicago Meeting of the American Association for the Advancement of Science, should be sent to F. W. Putnam, Salem, Mass., quite soon, to be in time for printing.—F. W. P.

BOOKS RECEIVED.

On the British Species of Alpheus, Typton, and Axius, and on Alpheus Edwardsii of Audouin. By the Rev. A. M. Norman. (From the Annals and Magazine of Natural History for September 1868.) 8vo, pp. 6.

Cecil's Books of Natural History:—Cecil's Book of Insects; Cecil's Book of Birds; Cecil's Book of Beasts. By Selim H. Peabody. Chicago: Clark & Co. 1868. 12mo.

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THE ABORIGINAL MOUND BUILDERS OF TENNESSEE.

BY DR. JOSEPH JONES.

When the first Anglo-American pioneers, about the middle of the last century, explored the country east and north of the Tennessee River, the territory between the Ohio and Tennessee Rivers was a vast unoccupied wilderness. The rich valleys, hills and plains of Tennessee and Kentucky were crowded with a dense growth of forest trees and canes, and formed an extensive park, held permanently only by the beasts of the forest, and abounding with immense herds of buffalo, flocks of wild turkeys, droves of deer and innumerable bears. The nearest permanent Indian settlements were on the Sciota and Miami on the north, and on the waters of the Little Tennessee on the south; and from these points the warriors of the Miami Confederacy of the north, and the Choctaws, Chickasaws and Cherokees of the south issued to engage in hunting and war, in this great central theatre. At this period, by common agreement of all the surrounding tribes, this section of country, which, for its fertile soil, numerous rivers and abundant supply of fish and game, was admirably adapted to the settlement of savage tribes, appeared to have been reserved from permanent occupancy.

That this country, in common with other portions of the

great Valley of the Mississippi, was inhabited in ancient times by a comparatively dense population, who subsisted by the arts of husbandry, as well as by the chase, is evident from the numerous depositories of the dead in the caves and along the banks of the streams in the fertile valleys, and around the cool springs which abound in this limestone region, and from the imposing monumental remains and extensive earthworks.

A considerable portion of the city of Nashville has been built over an extensive Indian graveyard,* which lay along the valley of Lick Branch. A large portion of these graves have been removed in the building of North Nashville. In this section of the city I saw a number of these stone graves, exposed during the digging of the cellars of a row of houses, and obtained a small stone hatchet, and another implement of hard, silicious stone, beautifully polished. This stone implement is supposed to have been used in the dressing of hides. All around the sulphur spring, traces of the aborigines are manifest in the form of fragments of large pots and various implements. It is supposed that this salt lick was frequented by the Indians for game and the manufacture of salt.

Extensive fortifications, several miles in extent, enclosing two systems of mounds and numerous stone graves, lie along the Big Harpeth, about sixteen miles below Old Town, at

* An extensive burying ground lies on the opposite bank of the Cumberland, directly across from the mouth of Lick Branch, and another about one and a half miles lower down; another at Cockrill's Spring, two and a half miles from the Sulphur Spring; another six miles from Nashville on the Charlotte Pike, and still another at Hayesborough. Numerous stone graves are also found on White's Creek, on the Dickerson Pike, nine miles from Nashville, and at Sycamore, twenty-two miles from Nashville, on the plantation of Colonel Overton, and in and around Brentwood, at the Boiling Springs, and on the plantation of Mr. Scales. Extensive Indian burying grounds are also found in White County, near Sparta, and along the various streams flowing into the Cumberland and Tennessee Rivers, as Harpeth, Duck, Elk and Stone Rivers. At the plantation of General DeGraffenreid, two and a half miles above Franklin, numerous stone graves are found within an extensive earthwork, which appears to have surrounded a considerable Indian town. One large square mound, 230 feet in diameter, together with a chain of smaller ones, are found within the ancient fortification, with mounds and stone graves. One of the most remarkable stone-grave burying grounds is found on the west fork of Big Harpeth, six and a half miles from Franklin, at a place called Old Town, the property of Mr. Thomas Brown.

Mound Bottom and Osborn's Place. At these extensive fortifications, which enclose the sites of two ancient cities, are found three pyramidal mounds, about fifty feet in elevation, and each one containing an acre upon its summit, and besides these, numerous lesser mounds. Such structures must have required the labor of a considerable population for a series of years; and more especially must the erection of these earth pyramids have been slow and tedious, as the aborigines were without horses or carts, and the immense mass of earth must have been carried by hand in baskets and skins. The old road or trail which connected these two ancient cities can still be discerned in the forest, the well-worn way being in some places a foot or more beneath the general surface. It is evident from these facts that a chain of fortified towns extended in ancient days all along Big Harpeth, and from careful excavations and examinations and comparisons of the crania and relics, we are convinced that they were all erected by the same race. One of the most remarkable aboriginal remains in Tennessee is found in the fork of Duck River, near Manchester, and is known as the *Stone Fort*. The walls of the fort have been formed of loose rocks and stones gathered from the bed of the river. The gateway of the fort, which opens toward the neck of land between the two branches of the river, is carefully protected by an inner line of works, so constructed that the enemy entering the fort would be received in a blind pouch or bag. Directly in front of the gateway of the fort, and about half a mile distant, stands a remarkable mound, the structure of which is similar to that of the walls of the fort, being composed of rocks, none of which exceed a foot and a half in diameter. This oblong mound is 600 feet in circumference and forty feet in height, and the labor of collecting and depositing the loose rocks by hand must have been considerable.

It would be impossible for us upon the present occasion to enter into a minute description of the mounds of Tennessee.

They are found upon the Cumberland, Little Tennessee, Big Tennessee, French Broad, Elk River, Harpeth, Duck and Stone Rivers. As a general rule these mounds are erected upon rich alluvial bottoms, and are either surrounded by extensive earthworks, or are located in the neighborhood of these fortifications, which mark the site of towns. The mounds vary in number and size, in a measure, with the extent and richness of the valleys and the size of the earthworks. The smallest are not more than a few feet in height, and about thirty feet in diameter, while the largest attain a height of seventy feet, and cover an acre or two of ground. Many of the smaller mounds were used for the burial of the dead, others for the purpose of religious sacrifice and for the burning of the dead, while the largest pyramidal mounds were most probably the sites of the temples and council-houses of the aborigines.

The ancient inhabitants of Tennessee also left singular paintings upon the rocks, representing the sun and moon. These paintings occupy the face of perpendicular cliffs on the Harpeth, Tennessee, French Broad, Duck and Cumberland Rivers. The paintings are executed with red ochre, upon high, inaccessible walls of rock overhanging the water, and were, without doubt, devoted to sacred purposes, and were emblematic of the sun, the god of the aborigines. The paintings of the sun on the rocks on Big Harpeth River, about three miles below the road which crosses this stream from Nashville to Charlotte, can be seen for a distance of four miles, and it is probable that the worshippers of the sun assembled before this high place for the performance of their sacred rights. At Buffalo Gap, on the same stream, where the ancient trail of the buffalo is still distinct, a line of buffaloes is painted upon the cliff rock which overhangs from above, and is capable of sheltering a thousand men.

We have still another evidence of the existence of a numerous population, in the fact that the first settlers found the caves filled with human skeletons.

Haywood relates that in the spring of the year 1811, two human beings were found in a copperas cave, in Warren County, in West Tennessee, about fifteen miles south-west from Sparta, and twenty miles from McMinnville. One of these persons was a male, the other a female. They were interred in baskets made of cane, curiously wrought, and evidencing great mechanical skill. They were both dislocated at the hip joint, and were placed erect in the baskets, with a covering of cane made to fit the baskets in which they were placed. The flesh of these persons was entire and undecayed, of a brown color, produced by time, the flesh having adhered to the bones and sinews. Around the female, next her body, was placed a well dressed doeskin; next to this was placed a rug, very curiously wrought of the bark of a tree and feathers. The bark seemed to have been formed of small strands well twisted. Around each of these strands feathers were rolled, and the whole woven into cloth of a fine texture, after the manner of our common coarse fabrics. This rug was about three feet wide, and between six and seven feet in length. The whole of the ligaments thus formed of bark were completely covered by the feathers, forming a body of about one-eighth of an inch in thickness, the feathers extending about one-quarter of an inch in length from the strand to which they were confined. Its appearance was highly diversified by green, blue, yellow and black, presenting different shades of color when reflected upon by the light in different positions. The next covering was an undressed deer-skin, around which was rolled in good order a plain shroud manufactured after the same order as the one ornamented with feathers. This article resembled very much in its texture the bags generally used for the purpose of holding coffee, exported from Havana to the United States. The female had in her hand a fan formed of the tail feathers of a turkey, curiously bound with buckskin strings and scarlet colored hair, so as to open and shut readily. The hair of these mummies was still remaining upon their heads, and

was of a yellow caste and very fine texture. De Soto, in his march in 1539 and 1540, saw great numbers of similar feathered mantles; the Mexicans at the time of the Spanish conquest were clad in similar garments.

The tribes of Indians inhabiting the immense territory called by the Spaniards, Florida, embracing a country of indefinite extent, bordering upon the Gulf of Mexico, and including a large portion of the Valley of the Mississippi, and the present States of Georgia, Florida, Alabama, Mississippi, and the middle and western portions of Tennessee, were more highly civilized, and farther advanced than those in more northern regions; they were worshippers of the sun, were governed by despotic princes, cultivated the soil, had made some advances in the arts, and their manners, customs and religion all pointed to Mexico as their native country.

The population was much greater at the time of the invasion of De Soto than it has been at any subsequent period. Large armies were frequently arrayed against him. In Potosa, Florida, he was furnished with seven hundred burden bearers. In Ocute, Georgia, he was supplied with two hundred of these Indian servants, and at Cafeque, in the same State, four thousand more transported the effects of his army. A numerous population was found in the province of Coofa, and large forces opposed him at Maubila, Chickasa, and Alabama. The invasion of De Soto resulted in the destruction of an immense Indian population in all the territory through which he passed; they were not only destroyed in the bloody battles by thousands, but they were worn out by heavy burdens, and hunted down with bloodhounds. The European diseases, which the natives inherited from the Spaniards, served also to thin out their population. Again, the constant bloody wars in which they were afterwards engaged among themselves, and which, to a great extent, grew out of the invasions, still farther reduced their numbers.

The towns were surrounded with walls of earth and palisades, and had towers of defense. Entrenchments and

ditches were also found in various parts of the country. The most remarkable of the latter was at Pascha, west of the Mississippi. Here a large ditch, "wide enough for two canoes to pass abreast, without the paddles touching," surrounded a walled town. It was cut nine miles long, communicated with the Mississippi, supplied the natives with fish, and afforded them the privileges of navigation.

The natives formed artificial mounds for purposes of burial, worship, habitation and defense. The houses of the chiefs, with but few exceptions, stood upon large and elevated artificial mounds. When the Indians of 1540 resolved to build a town, the site of which was usually selected upon low rich land, by the side of some stream, or in the neighborhood of a large never-failing spring, they first erected a mound from twenty to fifty feet high, round on the sides but flat on the top. The habitations of the chief and his family were erected upon the summit. At the foot of the eminence a square was marked out around which the principal men placed their houses, and around them the inferior classes erected their wigwams. Some of these mounds had stairways upon their sides, and were so steep as to be accessible only by the artificial way. They were thus rendered secure from the attacks of an Indian enemy. Mounds were also erected over the chiefs after their death, whilst others were formed by the slow accumulation of the dead through ages.

The aborigines, at the time of De Soto, worshipped the sun, and erected large temples, which were also receptacles of the bones of the dead. The natives worshipped the sun, and entertained great veneration for the moon and certain stars. When the Indian ambassadors crossed the Savannah to meet De Soto, they made three profound bows toward the East, intended for the sun; three toward the West for the moon, and three toward De Soto. Upon the eastern bank of the Mississippi all the Indians approached him without uttering a word, and went through precisely the same ceremony, making to De Soto, however, three bows much

less reverential than those made to the sun and moon. Similar customs prevailed on the west bank of this great river. In the morning every Indian presented himself at the entrance of his cabin, and extending his hands toward the sun, as his first ray beamed from the eastern horizon, addressed a rude but fervent hymn of adoration to his glory. At noon they performed a similar act in token of their gratitude; and to the setting sun they addressed their thanks for all the bounties they conceived he had bestowed upon them during the day; and they were particularly careful that his last ray should strike their heads.

A remarkable temple was situated in the town of Talmaco, upon the Savannah River, three miles distant from Cutifachique, near Silver Bluff. It was more than one hundred feet in length, and fifty feet in width. The walls were high in proportion, and the roof steep and covered with mats of split cane, interwoven so compactly that they resembled the rush carpeting of the Moors. The roof was covered with shells of various kinds, arranged in an ingenious manner. On the inside beautiful festoons of pearls, plumes and shells extended along the sides down to the floor. The temple was entered by three gates, guarded by gigantic wooden statues, some of which were armed with drawn bows and long pikes, and others with copper hatchets. On the sides of the walls were large benches, in which sat boxes containing the deceased chiefs and their families. Three rows of chests full of valuable pearls occupied the middle of the temple. The temple abounded with beautiful garments manufactured out of the skins of various animals, and in the most splendid mantles of feathers.

Upon the route through Alabama and the neighboring States, De Soto found the temples full of human bones. The large towns contained stone houses, filled with rich and comfortable clothing, such as mantles of hemp, and feathers of every color exquisitely arranged. The dress of the men consisted of a mantle of the size of a common blanket, made

of the various barks of trees, and a species of flax interwoven and dyed of various colors; also, well dressed and painted skins, and garments worn with beautiful feathers. The mantle was thrown over the shoulders with the arm exposed. Great men were sometimes, after the manner of the Mexicans, borne upon litters by their subjects, while their heads were shielded from the sun by shades made of feathers or gaudily painted hides.

The important conclusion which we draw from these investigations is: That the race which erected the mounds and fortifications of Tennessee was existing and active at the time of the discovery of North America, and possessed the country with a numerous population, even as late as the exploration of De Soto. This conclusion, which is at variance with the theories propounded by various ethnologists of Europe and America, who assign a considerable period to the extinction of the mound builders, will be still farther sustained by the remarkable discovery which we have made during the progress of these investigations, of the cross, emblems of the Christian religion, and especially of the Trinity, the Saviour and the Virgin Mary in the mounds of Tennessee. We believe that the preceding conclusion is based upon incontrovertible facts and evidence.

We will proceed to consider, in the next place, the mode of burial practiced by the aborigines of Tennessee, as shown by their sacred and sacrificial mounds and stone graves.

The ancient race of Tennessee buried their dead in rude stone coffins or sarcophagi, constructed of flat pieces of limestone or slaty sandstone, which abounds in Middle Tennessee. Extensive graveyards are found in Tennessee and Kentucky along the river courses, in the valleys and around the springs, in which the stone coffins lie close to each other. These graves, although justly regarded as rude fabrics, nevertheless exhibit considerable skill in their construction, and are standing memorials of the regard in which the ancient race held the memory of the dead.

The manner of burial appeared to have been thus: An excavation of the proper size, according to that of the body of the dead, was made in the ground, and the bottom carefully paved with flat stones. Long flat stones, or slabs of limestone and slaty sandstone, were placed along the sides, and at the head and foot of the grave. The body or skeleton was then placed within the rude coffin, and the top covered with a large flat rock, or with several flat rocks. When a number of coffins were constructed together, the side rocks of the first coffin frequently constituted the side of the second, and so on. Many of the graves are quite small, only capable of containing the body of a new-born infant. Many of the short square graves, not more than eighteen inches, or two feet in length, contain the bones of adults piled together, the head being surrounded by, or resting upon the arm and leg bones. This class of graves, containing the bones of adults packed in a small space, was probably constructed at the general burying festival, or contained the remains of the dead which had been transported from a great distance.

In a small mound, about forty-five feet in diameter, and about twelve feet in height, which I opened, about ten miles from Nashville, on the banks of a small stream and spring, and which contained perhaps one hundred skeletons, the stone graves, especially towards the centre of the mound, were placed one upon the other, forming in the highest part of the mound three or four ranges. The oldest and lowest graves were of the small square variety, while those near or upon the summit, were of the natural length and width of the skeleton within.

In this mound, as in other burial places, in the small square stone graves, the bones were frequently found broken, and while some graves contained only a portion of an entire skeleton, others contained fragments of two or more skeletons mingled together. The small mound now under consideration, which was one of the most perfect in its construc-

tion, the lids of the upper sarcophagi being so arranged as to form an even-rounded, shelving rock surface, was situated upon the western slope of a beautiful hill covered with the magnificent growth of the native forest. The remains of an old Indian fortification were still evident, surrounding an extensive encampment and several other mounds. In a large and carefully constructed stone tomb, the lid of which was formed of a flat rock, over seven feet in length, and three feet wide, I exhumed the bones of what was supposed to have been an ancient Indian chief who had passed his hundred summers. The skeleton was about seven feet in length, and the huge jaws had lost every vestige of teeth, the alveolar processes being entirely absorbed.

The hill upon which the residence of Col. Overton stands, about nine miles from Nashville, was in ancient times covered with a flourishing Indian village. The circular depressions of their wigwams are still visible. The aborigines appeared to have been attracted to this locality by the noble spring which bursts out at the foot of the hill. Thousands of bones were exhumed in excavating the cellar of the family mansion. The crest and south-eastern slope of the hill are covered with stone graves, many of which have been opened by curiosity hunters. A large number are concealed by the rank growth of weeds and grass. Those which I examined at this locality were all constructed upon the same plan. Here, as elsewhere, the graves were of various sizes, from that just sufficient to enclose the remains of a little child, up to the long stone coffin of eight feet. Some have supposed that these little graves enclosed a race of pigmies, but upon careful examination of many, at various localities, we discovered that they were simply the graves of the young; for we found the teeth in all stages of development, from the toothless child, through the period of dentition, up to the appearance of the wisdom teeth. Some of the small graves contained the bones of small animals, apparently of dogs, rabbits, squirrels and wild cats, and of birds, such as the wild

turkey. These animals were buried with the children. Some of the burial mounds were evidently used also for sacred and religious purposes, and were held in high veneration as the resting place of royal families. Thus, in a small mound which I explored, about one hundred feet in diameter and about ten feet high, on the eastern bank of the Cumberland River, opposite the city of Nashville, and just across from the mouth of Lick Branch, at the foot of a large mound, which had been apparently used as a residence, I discovered the following interesting remains:

In the centre of the mound, about three feet from its surface, I uncovered a large sacrificial vase, or altar, forty-three inches in diameter, composed of a mixture of clay and river shells. The rim of the vase was three inches in height. The entire vessel had been moulded in a large wicker basket, formed of split canes, and the leaves of the cane, the impressions of which were plainly visible upon the outer surface. The circle of the vase appeared to be almost mathematically correct. The surface of the altar was covered with a layer of ashes, about one inch in thickness, and these ashes had the appearance and composition of having been derived from the burning of animal matter. The antlers and jaw bone of a deer were found resting upon the surface of the altar. The edges of the vase, which had been broken off, apparently by accident during the performances of the religious ceremonies, were carefully laid over the layer of ashes, and the whole covered with earth near three feet in thickness, and thus the ashes have been preserved to a remarkable extent from the action of the rains.

Stone sarcophagi were ranged around the central altar with the heads of the dead to the centre, and the feet to the circumference, resembling the radii of a circle. The inner circle of graves was constructed with great care, and all the Indians buried around the altar were ornamented with beads of various kinds, some of which had been cut out of large sea-shells, others out of bone, and others again, were com-

posed of an entire sea-shell, punctured, so as to admit of the passage of the thread upon which they were strung.

In a most carefully constructed stone sarcophagus with the face looking to the setting sun, a beautiful shell ornament was found resting upon the breast bone. It had a central sun, and the large circle around this curiously divided into three figures or equal parts, with two outer rows of suns (nine suns in the outer row, making twenty-three suns in these two rows), making with the central sun, twenty-four suns in all; and with stars encircling the suns. This ornament upon its concave figured surface, had been covered with red paint; upon the back the convex plane surface was smooth and plain, with the exception of three crescentic marks.

The material of which it is composed was derived from a large flat sea-shell; no fresh water muscle, in any part of the waters of Tennessee and of the surrounding States, could furnish a uniform thickness of flat shell equal to this; and the regularity of its convexity and concavity, as well as the perfection of all its parts, and the uniformity of its thickness everywhere, are proofs that it must have been derived from a very large shell from the sea coast. This skeleton had around the neck, arms, waist and ankles, numerous beads of various kinds. The smaller beads were all of the small sea-shells. This stone grave had been constructed with such care, that little or no earth had fallen in and the skeleton rested as it were in a perfect vault. The head, which was evidently that of a woman, was in a remarkable state of preservation.

From the nature of the ornament upon the breast, as well as from the care with which the sarcophagus had been constructed, we judged that this was the priestess of the sun. In the grave of a child, near the right side of the grave of the priestess of the sun, and at the foot of the grave of a gigantic old Indian, seven feet in length, and of great age, as manifested by the loss of teeth, and the absorption of the alveoli, a curious small black idol was exhumed. The fea-

tures of this image resemble those of the Aztec, or ancient Mexican sculptures. The figure is kneeling, with the hands clasped across the breasts (forming a cross) in the attitude of prayer. This image is formed of a mixture of black clay and powdered shells, and is exceedingly hard, with a smooth, polished surface. The under jaw of the old Indian, whose grave lay near this idol, was of remarkable size, and had only one long, sharp fang, like the tooth of a wild animal. On the left of the grave of the priestess of the sun lay two other most carefully constructed graves, in one of which numerous beads were found, enclosing or encircling various portions of the skeleton, and in the other a large sea conch. Also two copper ornaments, lying on the side of the head of the skeleton, or rather two round pieces of wood, with a hole in the centre, and covered with a thin layer of copper. Two skeletons, apparently those of a man and woman, were found on the southern slope of the mound near the altar, which had been interred without any stone coffin. In the hand of the woman was a beautiful, light reddish yellow vase, painted with regular black figures. Under the head of the male skeleton lay a splendid stone hatchet with the entire handle and ring, at the end of the handle, cut out of a compact green chloritic primitive stone. A circle of graves extended around the inner circle, which we have described as radiating from the altar. The stone coffins of the outer circle lay at right angles to the inner circle, and rested as it were at the feet of the more highly honored and favored dead. In the outer graves no ornaments were found—only a few small arrow heads and fragments of shells and pots. After careful examination, we were forced to the conclusion that this sacred mound was formed at the time of the death of some celebrated chief or chieftess, the representative of the sun; and the more distinguished members of the family were buried in the inner circle around the altar, where the eternal fire was kept, and the more humble relatives and attendants around at their feet. It is probable that this sacred

mound marked the site of an ancient temple of the sun, in which the aborigines kept the eternal fire. The sacrifices upon the altar appear, from the bones of the deer, the antlers, etc., to have been not human, but animal.

That the aborigines of Tennessee were idolaters, is manifest from the stone and clay idols, which have been found in various portions of the State, some of which were found in caves, and others upon the summit of high mounds.

It is worthy of notice that some of the idols have the forehead flattened, making an exact line with the nose, and resembling in all respects the Toltec heads of Mexico, while others are represented with full round foreheads; and it is still further worthy of notice that the hair of the head of the idols is represented in a very different mode from that in which the nomadic tribes of North American Indians now wear it. In the female idols the hair is gathered into a knot or "waterfall" behind, while in the male idols it is bound into a cue behind, like the hair of the Chinese. These remarkable sculptures in hard sandstone, limestone and porphyry, correspond in features and mode of hair dress with the inhabitants of Central America, at the time of the Spanish conquest.

Herera, in describing the inhabitants of Yucatan, says: "They flatten their heads and foreheads, their ears were bored, with rings in them, their hair was long like women, and in tresses, with which they made a garland about the head, and a little tail hung behind."

The most important and interesting result in the entire series of investigations is the discovery of undoubted symbols of the Catholic religion in the stone graves and mounds of Tennessee. In a stone grave in a small mound within an extensive fortification on the banks of Big Harpeth River, two and a half miles from Franklin, on the plantation of General DeGraffenried, four copper crosses were exhumed, resting upon the skull of an old Indian. The copper had stained the bones of the cranium of a deep green color. In

their general outlines two of these crosses presented the general contour of the human figure. The crosses appear to have been stamped upon the copper plates with a die.

This grave also contained a remarkable vase, fashioned of a light yellow clay and crushed river shells, upon the sides of which were painted in black, three crosses, surrounded with three circles and three crowns. The rounded body of the vase was accurately divided into three portions, by the black pigment disposed in three black bands, uniting at the base and neck of the vase, thus leaving three circular spaces, upon the rounded sides, which were ornamented with the central cross, an outer circle around each cross, while this circle was again surmounted by the crown. Each crown had ten prominences or points. The superior portion of the neck of the vase was arched and so turned as to form the mouth horizontally. The summit of the vase terminated in a well shaped nipple.

In a similar burial mound within the same enclosure, amongst other most interesting relics, we discovered two large vases, marked in a similar manner, with three divisions, three central crosses, three circles around the crosses, and three crowns. In these large vases the points of the crowns were drawn out so as to resemble spikes and thorns, and in one of the vases the ends of the thorns, or those portions which would form the circle of the crown are represented as if plaited together. Two vases of similar construction were also exhumed, one with the head of a Spaniard, with a helmet upon the crown. The resemblance of the features to those of a Spanish Cavalier is wonderful. This small vessel was used as a paint bowl, and still contains the red ochre. The other black vase is fastened on the summit after the manner of a hood. Another small idol fashioned of white clay, found in Middle Tennessee, painted with the same black pigment, and dressed in what appears to represent a woven garment, has the sign of the cross upon both shoulders. The idol found in the sacred mound, as we have before

said, has the arms crossed upon the breast, in the attitude of prayer, the crown upon the head has three prominences, and the hatchet has three marks upon its head, and the beautiful shell ornament from the same mound has the symbol of the Trinity, both upon the anterior and posterior surfaces.

A circular shell ornament, with a well formed crown in the centre, which had been filled with some kind of red pigment, was discovered by Colonel Putnam in a stone grave near Nashville.

These religious relics are of a great interest in their bearing upon the probable date of the mounds and temples and graves in which they are found, and in the proof which they afford, that the inhabitants of America, have, at various times, come in contact with the civilization and religions of Europe, even before the recognized era of the discovery and exploration of the American continent.

In several of the crania, the os-Incae, characteristic of the Peruvian skulls, was observed. That this ancient race were descended from the Toltecs, and were probably a branch of the Natchez, is rendered probable, not only from the conformation of the crania, but also from the history of this once powerful, but now extinct nation of the Natchez.

THE FAUNA OF MONTANA TERRITORY.

BY J. G. COOPER, M. D.

(Continued from page 35.)

CAT BIRD (*Mimus Carolinensis*). I was surprised to find the Cat Bird common entirely across the Rocky Mountains to Cœur d'Aleñe Mission, almost on the border of the Columbia Plains. It has the usual cry and habits of the species. I thought I saw *Oreoscoptes montanus* along the Hell Gate River, but may have been mistaken.

ROCK WREN (*Salpinctes obsoletus*). I observed this bird

occasionally through the main Rocky Mountain chain, to near the crossing of the Bitterroot, but less common than among the cliffs and rocks of the barren plains along their eastern slope. Though neither Dr. Suckley nor myself found it in the western part of Washington Territory, I have no doubt that it frequents parts of the rocky cañons of the Columbia Plain, and Nuttall says that he saw it at the "lowest falls" (Cascades) of the Columbia (Manual, second edition, Vol. I, p. 492). A nest with nine eggs was found in a log cabin below Fort Benton.

WINTER WREN (*Troglodytes hyemalis*). Seen only near the summit of the Cœur d'Aleñe Mountains, in September.

CREEPER (*Certhia Mexicana*). Rather common, especially in the dark spruce forests of the Cœur d'Aleñe Range. Habits and note exactly as in the eastern bird (*C. Americana*).

LONG-BILLED NUTHATCH (*Sitta aculeata*) and RED-BELLIED NUTHATCH (*S. Canadensis*). Both common in the Rocky Mountains as in the Cascade Range, but rare in the dense forests.

PIGMY NUTHATCH (*S. pygmæa*). Flocks of this little bird were met with at intervals from the eastern base of the Rocky Mountains, in August, to the Spokan River and Fort Colville, frequenting the open woods of pine (*Pinus ponderosa*), and were more gregarious, lively and noisy, than the preceding, constantly chirping like young chickens, and like them seeking insects more among the leaves than in the bark. It has also at times a harsh call much like the others.

NORTHERN TITMOUSE (*Parus septentrionalis?*, var. *albescens*). I obtained a specimen of this bird on the bank of the Missouri within the mountains, and as it is found at Fort Bridger, have little doubt of its crossing into Washington Territory, though I did not again recognize it among the many *Pari* I saw afterwards. The cries and habits of all these black-capped species are so nearly similar, that it requires a very near approach to distinguish them.

WESTERN TITMOUSE (*P. occidentalis*). Common in the Rocky Mountains, associating with the Mountain Titmouse.

MOUNTAIN TITMOUSE (*P. montanus*). Rather less abundant than the last, but alike in habits; call-note rather harsher. Both of my specimens are larger than more western ones. Seen with the last named at Fort Dalles, Oregon.

RUFOUS-BACKED TITMOUSE (*P. rufescens*). I met with this only in the dense forests of the higher Cœur d'Alene Mountains, along with *Turdus nævius*, *Trogl. hyemalis*, etc., the same group most common in the similar forests of the Coast Mountains in this Territory. It there seemed to have all the business of Titmice to itself, and in notes is easily distinguishable from any of the preceding, though similar in habits. I saw it nowhere else east of the Cascades.

HORNED LARK (*Eremophila cornuta*). Abundant in the more open prairie districts everywhere. I found many of its nests along the Upper Missouri.

EVENING GROSBEAK (*Hesperiphona vespertina*). During my residence west of the Cascade Mountains, in 1854, I often heard a call uttered by some bird flying above the tops of the highest trees, and audible for a mile in still weather. I heard the same among and near the Cœur d'Aleñe Range, and saw the birds, but too high to distinguish the species. They made the cry only when flying from one tree to another, and when feeding among the top branches of the highest trees were so quiet that I never could even see them. I always supposed them to be the Evening Grosbeak, which they resemble in size, and Townsend's observations of its habits and notes agree closely with these remarks. (Nuttall, Manual, 1840, Vol. I, p. 620).

The habits of the Black-headed Grosbeak are quite different, as it lives commonly among bushes, or near the ground in open woods, and has no such cry. The birds seen may possibly, however, have been Pine Grosbeaks, which belong to the same long-winged group of arboreal finches, and were collected in these mountains in winter by Mr. Hildreth.

Purple Finch (*Carpodacus*). I saw none throughout the journey.

Yellow Bird (*Chrysomitris tristis*). I saw this bird at the eastern base of the Rocky Mountains, and as it occurs also along the lower Columbia it is probably to be found in summer through nearly the whole territory. Nuttall found its nest on Lewis' (Snake) River. (Vol. I, p. 595).

Pine Finch (*C. pinus*). Common throughout the mountains.

Red Crossbill (*Curvirostra Americana* var.? *Mexicana*). Common throughout, and very abundant in the spruce forests of the Cœur d'Aleñe Mountains, where it is remarkably familiar, feeding and dusting much on the ground, especially about the few log cabins built there. Among large numbers closely observed, I saw very few of the white-winged species. The male sometimes uttered a few musical notes much in the style of the Yellow Bird (*C. tristis*), but louder. The specimen preserved is much larger than those I collected on the west coast in 1853, with the bill also larger, and the proportions are even greater yet than those of Strickland's *L. Mexicana*, from the City of Mexico. (Baird's Rep., p. 924). The habits and notes are so universally similar that the various sizes can scarcely indicate more than local varieties, such as occur in nearly all our widely spread species. The bill and feet were, however, black instead of brown.

White-winged Crossbill (*C. leucoptera*). The specimen preserved was shot from a flock of the common kind, on the eastern slope of the Cœur d'Aleñe Mountains, by Capt. Floyd Jones.

Chestnut-colored Bunting (*Plectrophanes ornatus*). I found this species with fledged young in July, on the plains near Fort Benton, where it evidently breeds.

Large Savannah Sparrow (*Passerculus Sandwichensis*). This specimen I shot on the Spokan Prairie, September 24th, and saw a few more there and on other parts of the interior plains of Washington Territory afterwards. From the earli-

ness of the season, I suspect that it breeds in these regions, migrating to the coast for the winter, where I found it from October to May, in 1854. In habits it resembles the other Savannah Sparrows.

LARK FINCH (*Chondestes grammaca*). Common near Fort Benton, and occurring in small numbers on the prairies in and west of the Rocky Mountains.

WHITE-CROWNED SPARROW (*Zonotrichia Gambelii*, or *Z. leucophrys?*). I found this species only in the Cœur d'Aleñe Range, from which circumstance I suppose it to be the *Z. Gambelii*. The young specimen preserved had brown feet, while the adult has them yellow in summer, but brownish in winter.

OREGON SNOWBIRD (*Junco Oregonus*). I saw no Snowbirds until September 1st, after which migrating flocks were common. I could only distinguish this species among them, though I saw some of a paler hue about the head, probably from immaturity.

CHIPPING SPARROW (*Spizella socialis*). Common throughout the journey, and nests were found on the Upper Missouri.

BREWER'S SPARROW (*S. Brewerii*). I found flocks, apparently of this species, on the eastern slope of the mountains only, migrating South in August. Two which I shot I took for the young of *S. socialis*, and did not preserve them, but I now think they were of this species. They frequented the open pine woods, which the former rarely does, preferring prairies.

The distinction of this from *S. pallida* is like that of young birds of the genus generally, and the lists of specimens given by Baird show that all may have been young birds, judging from the period of the year they were collected in.

WESTERN SONG SPARROW (*Melospiza rufina*). This Song Sparrow was common in the Rocky Mountains, and appeared to me to resemble *M. rufina* of the Pacific Coast in every respect.

BLUE LINNET (*Cyanospiza amœna*). I saw this bird on

the eastern slope of the Rocky Mountains, but not among them, though it probably occurs there sparsely.

LINCOLN'S FINCH (*M. Lincolnii*). Rather common in flocks along the Bitterroot River, migrating in September.

ARCTIC GROUND-FINCH (*Pipilo arcticus*). I observed specimens which I supposed to be of this species, entirely across the Rocky Mountains, and preserved one from each side. In habits they resembled the eastern and west coast species, and I observed little difference in their notes at that season from those of *P. Oregonus*. I also preserved a nest and eggs of this (?) from along the Missouri River.

BOBOLINK (*Dolichonyx oryzivorus*). At several points in the valley of the Bitterroot River, I heard and saw at a distance what I took for the Bobolink, the flight and flying-call exactly resembling that bird's. At Cœur d'Aleñe Mission I again met with it, but could not get near enough to shoot it or determine the species, though they frequented a wheat-field for several mornings. I know no bird likely to be mistaken for it, and having been found at Fort Bridger, a few probably go north to latitude 47° 30′, as they go to latitude 54° east of the mountains, according to Richardson. The *Calamospiza*, which is common near Fort Benton, I saw no farther west, and its notes and habits are quite different.

COW BUNTING (*Molothrus pecoris*). I saw this bird only once near Fort Benton, but as it abounds along the Platte River and follows trains of wagons, cattle, etc., besides being found at Fort Bridger and Sacramento, Cal., I should be surprised if it did not occur in the present limits of Washington Territory, at least along Snake River, and possibly follow emigration as far as the Cascade Mountains. I see no reason why it should not also emigrate to the open regions north of the Columbia; and Townsend has it in his list of "Oregon" birds (1834).

RED-WINGED BLACKBIRD (*Agelaius phœniceus*). Common at Cœur d'Aleñe Mission, Fort Colville, and Bitterroot Valley.

WESTERN LARK (*Sturnella neglecta*). Found on every prairie throughout the Rocky Mountains.

WESTERN GRACKLE (*Scolecophagus cyanocephalus*). Common in all marshy meadows of the Rocky Mountains, except at a very high elevation.

RAVEN (*Corvus carnivorus*). A constant attendant at camp, especially when about to be broken up.

EASTERN CROW (*C. Americanus*). At Sun River, east of the Rocky Mountains, I saw several of this species, and noticed no peculiarities as to flocking, note, etc.

WESTERN CROW (*C. caurinus*). The first crows I saw west of the dividing ridge were a distant flock, at sixty miles, and again at a camp about twenty miles above the junction of Hell Gate with the Bitterroot River, where a flock of about one hundred flew over at dusk, probably towards a roosting place. Their gregariousness at that season (August 25th), and unusual noise, struck me as peculiar; and on other occasions farther down the valley I saw some, but most of them probably live near the settlements of the St. Mary's Valley.

At Cœur d'Aleño Mission I again found *large flocks* of crows, and on comparing one with the plates and descriptions contained in the Natural History of Washington Territory, I found it to agree with *C. caurinus* in the form of the bill, but to be intermediate between it and *C. Americanus* in size, though nearest the former. I am inclined to think it was *caurinus*, but, like several other Rocky Mountain specimens collected by me, larger than those of the same species from the coast. Its habits were different from those of *C. Americanus*, and as it occurs at the Dalles, it could easily cross the intervening country. It cannot, however, be much of a "fish-crow" in these mountains.

CLARKE'S NUTCRACKER (*Picicorvus Columbianus*). I found this bird from the first pine forests east of the Rocky Mountains entirely across, but more rare in the spruce forests, as it is in those west of the Cascade Mountains, evi-

dently because it feeds chiefly on the seeds of the Yellow Pine (*P. ponderosa*), which is either wanting or scarce among the spruces. I noticed large flocks flying in very loose order, with a steady, pretty rapid motion like a Jay, not in the least "by jerks, in the manner of a Woodpecker," as described by Townsend (Nuttall, Manual, 1840, Vol. I, p. 252).

BLACK-BILLED MAGPIE (*Pica Hudsonica*). No Magpies appeared along the Missouri River in June, until we had entered the "Bad Lands," where it cuts through the first mountain range, and pine woods began to appear. Thence they continued common throughout the route westward, and on reaching Vancouver, October 30th, I found them for the first time about there.

STELLER'S JAY (*Cyanura Stellerii*). I saw no Jays myself until we crossed the Bitterroot River, when they became common in the spruce forests. Dr. Suckley, however, found this species at St. Mary's Valley, in October 1853.

CANADA JAY (*Perisoreus Canadensis*). This bird appeared near the crossing of the Bitterroot, and was also common in the spruce forests of the Cœur d'Aleñe Mountains, these being its favorite summer residence as they are near the coast.

BAND-TAILED PIGEON (*Columba fasciata*). I saw but one bird, which I think belonged to this species, near Cœur d'Aleñe Mission, at the base of the most western range of mountains. It seems to leave the Rocky Mountains almost entirely to the next species, though a few have been obtained farther south, along their eastern base, by Say and Peale. (Nuttall, Manual, Vol. I, p. 753.*)

PASSENGER PIGEON (*Ectopistes migratoria*). The Passenger Pigeon, like the Cat-bird, astonished me by its frequency in the Rocky Mountains, as, although I saw no very large flocks, I saw some almost every day until I passed the Spokan Falls, just north of the Columbia Plains, where Lieut.

*I saw a flock at the Cascades of the Columbia as late as October 29th.

A. V. Kautz shot two. It thus seems to pass round to the north of that plain, and occasionally to cross the Cascade Range, as mentioned by Dr. Suckley in 1853.

Along the Missouri I often saw small flocks, and noticed quite a number of their nests in small trees between Forts Pierre and Berthold. I found one sitting June 7th, and heard that many build farther south, near Sioux City.

In the mountains they fed, in August, chiefly on the Service-berry (*Amelanchier alnifolia*), which, along the Hell Gate, attains a size and flavor unequalled by any I have seen elsewhere.

DOVE (*Zenaidura Carolinensis*). I did not see this bird anywhere in the mountains, though I found it above Fort Union, on the Missouri.

DUSKY GROUSE (*Tetrao obscurus*). This Grouse was shot at the very beginning of pine woods on the east base of the Rocky Mountains, and I often killed them afterwards all the way to Fort Colville, but none in very good plumage up to October.

FRANKLIN'S GROUSE (*T. Franklinii*). The first specimen met with was shot through the head with a pistol ball, by Lieut. L. R. L. Livingston. It is much smaller than numbers 123 and 124, which were trapped by the Indians near Fort Colville, three weeks later. I did not see any alive myself, but was told that in winter they are common south to Spokan River, and very stupid, standing by the roadside to be shot, having doubtless descended from the mountains, where they were unmolested. They are also common in summer near the pass, 5100 feet above the sea, on the Cœur d'Aleñe Range.

I now believe that two young specimens, one killed in Klickatat Pass, Cascade Mountains, in August 1853, the other near Spokan River, in October 1853, and mentioned in my Report as *T. obscurus*, "running through the snow," were of this species. In their immature plumage I then supposed the red mark over the eye to be merely a character of the

young. The "Small Brown Pheasant" of Lewis & Clark (?) is probably the immature *Lagopus leucurus*, which inhabits much more Alpine districts than any we traversed.

SHARP-TAILED GROUSE (*T. Columbianus*). This Grouse occurs abundantly at most of the prairie regions passed through, on Sun River, Deer Lodge, Bitterroot (St. Mary's) and Spokan prairies, probably finding its way down around the valley of Clark's Fork, and reaches Fort Colville in small numbers. I saw none, however, in the higher prairies of the Rocky Mountains, over 4500 feet above the sea.

SAGE-FOWL (*Centrocercus urophasianus*). I saw nothing of the Sage-fowl, which Col. Vaughan, who had a specimen killed near Fort Benton, says is very rare there. None were seen by our party on the Columbia Plains, north of Snake River, where they were common in 1853.

RUFFED GROUSE (*Bonasa Sabinii* var.? *umbelloides*). I shot several specimens of this Ruffed Grouse from the east base of Mullan's Pass to Fort Colville, most of which were young or moulting, but showed more or less brown in their plumage, thus connecting the above named variety (?) with the other two forms, which it entirely resembles in habits, etc. I saw a much grayer one near Fort Colville in 1853.

GRAY CRANE (*Grus Canadensis*). Only two observed in the Rocky Mountains, and none elsewhere, except a tame one near Fort Colville, which followed our horses for some distance apparently for the pleasure of a race, running with wings spread until it was passed, then flying ahead and circling round to meet us again. It refused a piece of bread thrown to it.

BLUE HERON (*Ardea herodias*). I did not see this, nor any other species of Heron, west of Fort Benton. Lewis and Clark, as well as Dr. Newberry, speak of seeing White Herons below Snake River.

MOUNTAIN PLOVER (*Aegialitis montanus*). Rare along the east base of the Rocky Mountains, usually about the Prairie-dog villages, and might be expected to cross the

mountains as it does farther south. I do not recollect, however, having seen any of the small waders anywhere in the mountains, though I noticed the Field Plover (*Actiturus Bartramius*) at the eastern base of Mullan's Pass, a bird never yet obtained *west* of the mountains.*

WILSON'S SNIPE (*Scolopax Wilsonii*) was seen at Cama, Prairie Creek, on the eastern border of the Columbia Plains, about the end of September.

ESQUIMAUX CURLEW (*Numenius borealis*) breeds near Fort Benton, where young were caught in July, still downy, but I have seen no Curlew on the Columbia Plains, though a species is said to abound near Fort Dalles, Oregon, in the spring.

SWAN (*Cygnus Americanus?*). Swans were seen in large flocks on the Columbia River, in the Cascade Cañon, as early as October 29th, this year (1860), and their migration southward seemed generally early. I saw them, however, on lakes of the Columbia Plain about the same time in 1853.

CANADA GOOSE (*Bernicla Canadensis*). Great numbers of this goose breed along the Missouri, where we saw broods every day from Fort Leavenworth up to Fort Benton. They are said to lay in nests, *on* trees, probably deserted nests of some other large bird. I saw two at Spokan River, Washington Territory, September 25th, which were probably summer residents there.

MALLARD (*Anas boschas*). Common in summer in the valleys of the Rocky Mountains, where it breeds.

GREEN-WINGED TEAL (*Nettion Carolinensis*). Common at St. Mary's Valley in August, and probably breeds in the mountains.

ROCKY MOUNTAIN GOLDEN-EYE (*Bucephala Islandica?*). I saw some dark headed ducks, perhaps this species, which was so long supposed to be peculiar to the Rocky Mountains,

* Yellow-legs (*Gambetta melanoleuca*) were obtained by Dr. Suckley at St. Mary's Valley, in 1853.

high up the Little Blackfoot River, but did not succeed in killing one.

SHELDRAKE (*Mergus Americanus*). I shot a female bird of this species at the highest camp on the Little Blackfoot River, near where it doubtless had raised a brood, as they seek such clear rapid streams for that purpose in the Cascade Mountains. *M. serrator*, the female of which is so much like this, has probably never been obtained far from the coast.

WESTERN GREBE (*Podiceps occidentalis*). I found this Grebe on the Alkaline lakes of the Columbia Plain, October 8th, about the same time of year that I obtained the first known specimen from near Walla Walla, in 1853. Its breeding place may be on the shores of these lakes.—*To be concluded.*

THE FOSSIL REPTILES OF NEW JERSEY.

BY PROF. E. D. COPE.

(Continued from Vol. I, page 30.)

WHILE grim and monstrous Dinosaurs ranged the forests and flats of the coast of the Cretaceous sea, and myriads of Gavials basked on the bars and hugged the shores, other races peopled the waters. The gigantic Mosasaurus, the longest of known reptiles, had few rivals in the ocean. These Pythonomorphs were the sea-serpents of that age, and their snaky forms and gaping jaws rest on better evidence than he of Nahant can yet produce.

Ten species of this group are known from the Cretaceous beds of the United States, of which six have been found in New Jersey. Two others occur in Europe. In relative abundance of individuals, as well as of species, New Jersey is much in advance of any other part of the world where excavations have been made.

COPE ON FOSSIL REPTILES OF NEW JERSEY.

These creatures have been referred to the neighborhood of the Varanidæ or Lace-lizards, which now haunt the shores of rivers in the tropics and southern regions of the Old World. Cuvier, Owen and others, have expressed this view, and there has been little dissent from it expressed by palæontologists. They readily constitute, however, a distinct order of reptiles, combining features of serpents, lizards, and Plesiosaurians. This is readily understood by the light of the abundant material discovered in various parts of the United States. The lizard-like affinities are, it is true, to the Varanians rather than to any others.

The Mosasaurus was a long slender reptile, with a pair of powerful paddles in front, a moderately long neck and flat pointed head. The very long tail was flat and deep, like that of a great eel, forming a powerful propeller. The arches of the vertebral column interlocked more extensively than in other reptiles except the snakes, presenting in a prolongation of the front of one, which enters beneath that immediately in advance of it, a rudiment of that extra articulation called the "zygosphenal." In the related genus Clidastes, this structure is as fully developed as in the serpents, so that we can picture to ourselves its well known consequences: their rapid progress through the water by lateral undulations; their lithe motions on land; the rapid stroke; the ready coil; or the elevation of the head and vertebral column, literally a living pillar towering above waves or brush of the shore swamps. While the construction of the skull was as light as that of the serpents, it was, apparently, not so strong. The sutures are more frequently of the squamosal type, and the brain case was not as fully ossified in front. The teeth, too, are less acute, and therefore less adapted for retaining struggling prey. While the jaws were longer, the gape was not so extensive as in serpents of the higher groups, for the os quadratum, the suspensor of the lower jaw, though equally movable and fastened to widely spread supports, was much shorter than in

them. But there was a remarkable arrangement to obviate any inconvenience arising from these points. While the branches of the under jaw had no sutural connection, and possessed independent motion, as in all serpents, they had the additional peculiarity, not known elsewhere among vertebrates (except in a few snakes), of a movable articulation a little behind the middle of each. Its direction being oblique, the flexure was outwards and a little downwards, greatly expanding the width of the space between them, and allowing their tips to close a little. A loose flexible pouch-like throat would then receive the entire prey, *swallowed between the branches* of the jaw; the necessity of holding it long in the teeth, or of passing it between the short quadrate bones would not exist. Of course the glottis and tongue would be forwards. The physiognomy of the reptile, with apparently dislocated jaws and swollen throat, as he passed a Chimæra to his internal laboratory, could scarcely be prepossessing.

The Clidastes and Macrosaurus were the more slender of these heteroclite beings, while Mosasaurus embraces the most gigantic. The *Clidastes iguanavus* could not have been shorter than thirty feet, and presented a reduction of the length of the paddles, consistent with its thoroughly serpent-like vertebral column. *Macrosaurus validus* considerably exceeded this length. *Mosasaurus Mitchellii* and *M. Missuriensis* propelled sixty feet of length through the waves, while no portion of these have been found to equal the *M. maximus*, which have recently been exhumed.

The reptilian whales of those troublous times, were the Cimoliasaurs and Elasmosaurs. These were the Plesiosaurs of Cretaceous life, and probably had a great range over the earth. Portions of them have been found in England and North America to our far western regions. Cimoliasaurus appears to have resembled Plesiosaurus in general, while Elasmosaurus added to its type an enormous and flattened tail, relatively as long as that of the Mosasaur, or the modern

Iguana, but not so flat as in the former; perhaps it were more as in the Crocodile as to compression, while relatively still longer. But both of these types present one strange feature. The processes which connect the arches of the vertebræ, are related to each other in directions the reverse of that which prevails among vertebrata generally, being perhaps the same as the zygosphen of the serpent and Clidastes, without the usual accompaniment. But the more probable explanation is, that they are the usual "zygapophyses" with the articular faces somewhat altered in direction. They are very oblique, turned a little over from the perpendicular, which latter position is sometimes more or less approached by these processes in other animals.

The *Elasmosaurus orientalis* rests on the evidence of but few remains, but these are like those of its better known congener *E. platyurus*. The vertebræ are nearly as large as those of an elephant, and indicate a totally different type of reptile from the Mosasaurus. The bulk was whale-like, the neck long and flexible, while short paddles and the serpent-like tail, sped this most colossal of our sea-saurians on his destructive career. The skull was light, and with a long narrow, and very flat muzzle; the nostrils or spout-holes were near the orbits; the teeth long and cylindric, and much sharper than those of the Mosasaurus. The most ravenous fish—the Enchodi, or great *barracudas* of the Cretaceous, were his food, and few we might suppose could escape the plunge from the elevated position whence he scanned the waters for prey. *Cimoliasaurus magnus* is more abundant in New Jersey. In bulk it was little inferior to the last, but it was apparently abbreviated and depressed behind, and so must have presented a very peculiar form. Precisely what that was and whether it supported a caudal fluke, we must determine hereafter. *Elasmosaurus platyurus* was forty-five feet in length.

While the crocodiles are most numerous in individuals in the deposits of this period, the turtles exceed them and all

other orders in the number of species. There have been twenty found in the Cretaceous of New Jersey, and three additional ones are known from the Tertiaries of the same State. The Cretaceous turtles may be arranged under four heads, viz., true Emydes or fresh water forms; Chelydrine Emydes, or snappers; Trionychidæ or soft shells; and Hydraspididæ, a type now confined to the Southern Hemisphere, which throw the head round the side of the shell, instead of drawing it in. It will be observed that all of these forms occur at the present day in fresh water only, and that true marine turtles are not found in this part of the Cretaceous formation. Add to this the fact that the crocodiles are rather estuary and river animals; that the Dinosaurs are terrestrial; and that by far the most abundant shells of the same region are oysters and Exogyræ, and we have indicated a condition of occasional separation from the high ocean, by seaward bars and islands, or even by occasional considerable strips of dry land.

The Emydiform turtles all belong to the genus *Adocus* of Cope, and were often of the size of our large gulf species, but generally of far more massive structure. The snapper-like forms are more numerous; they have been taken to be marine types, and indeed their fore-limbs appear to have been more paddle-like than those of the species of our modern rivers. They are represented by nine species, which pertain to five genera. These forms differ much in the relative union of the shield of the carapace, and its marginal pieces. In the genus *Peritresius* of Cope, the margin was largely separate, and the shell covered by a thin skin; in *Lytoloma* Cope the margin was also distinct, except in front and rear, and the carapace was covered by heavier shell-like dermal plates. *Propleura* Cope contained one large species—*P. sopita*, where the margin was broad and flat, and free as in the last, except that it had a broad union with the disc in front. Finally *Osteopygis* Cope, was solidly knit fore and aft by suture between disc and margin. Of its three species,

O. chelydrinus presented sharp points round the circumference, like a snapping tortoise. *O. emarginatus* had open notches between, at the same parts of the margin, and *O. platylomus* was even. *O. emarginatus* was the giant of all the snappers and probably commonly reached a length of six feet. An ally, the *Euclastes platyops*, whose cranium has been found, presented a broad, massive palatal surface, apparently for crushing, rather than the sharp edges and hooked bill of the raptorial snapper. It may have crushed shells for food. The *Lytoloma angusta* Cope shows a similar type of jaws. In the Euclastes, the skull measures about a foot in length, and eight inches in width, and accommodated immense temporal muscles, which indicate the power of its bite.

More elegance and less strength characterize the Hydraspid species. Five of these have been described, as follows: *Bothremys Cookii* Leidy; *Prochonias sulcatus* Leidy sp.; *P. strenuus* Cope; *P. princeps* Cope, and *Taphrosphys molops* Cope.

In the first we have a well protected cranium with small eyes, with the Milesian traits of a broad mouth, a pug-nose, and a stiff upper lip. His form seems to combine the capacities of doing as much injury to others and receiving as little himself as possible. What his shell was we do not know, but we know that he could not draw his head into it, by reason of a peculiar structure on the sides of his inner nostril. Of the other genera, the numerous shell fragments tell a similar story. It is only necessary to see whether the pelvis was attached to the lower shell, or plastron, to know whether the cervical vertebræ would form a sigmoid, and be withdrawn into the shell, or a horizontal curve and turn round outside, as a goose rests its head above its wing. Or, if the front part of the plastron only be found, if there be a supplemental plate in the front, we know both the flexure of the neck, the arrangement of the pelvis, and the structure of the nose. Such is a result of the law of correlation,

which holds through long series of forms, but must be carefully modified for other series, and in some points cannot be read at all.

In Prochonias, as in the modern genus of Brazil, *Hydromedusa*, the ileum is fastened by a great suture to the shell above, right on the line of junction of two rib bones. But the bones of the front of the carapace, are quite different from those of Hydromedusa. In Taphrosphys the structure is more powerful. The rib bones are united into one, and rise up round the sutural scar, leaving it at the bottom of a deep pit. *T. molops* was a powerful swimmer, and perhaps what he lost in mass, was gained in speed. The bony shells of both this genus and the last, are sculptured with netted grooves (*P. sulcatus and P. strenuus*) or ribbed lines (*P. princeps*, and *T. molops*), and they were probably covered with a thin skin instead of dermal scales. *P. princeps* was large and massive, equalling some of the snappers.

The more beautifully marked "soft-shelled" forms, the *Trionyches*, are represented by three species. Their position shows that they lived at an earlier period than in Europe. The Trionyx of our Miocene (*T. lima* Cope) was large and rough, with narrow sharp ridges. Its remains occur with Dolphins and Porpoises, but it may have been floated or washed from the mouth of a fresh-water stream into such strange company.

The Crocodiles of the modern period are characterized by the hollow crowns of their teeth, and one genus of the Cretaceous, viz., *Bottosaurus* Agassiz, possesses a similar dentition. Most of the Miocene species of both Europe and America possess, on the contrary, solid crowns, composed of closely concentric cones, as we see in Mosasaurus and some other reptiles. Some of them have been on this account mistaken for Mosasauroids, but none of the latter are known above the Cretaceous. In this country the Miocene forms of this kind are gavials, of even larger size than those of the Cretaceous. They belong to the genus *Thecachampsa* Cope, of

which *T. sericodon* was first discovered by Dr. H. C. Wood in Southern New Jersey, and *T. sicaria* by Philip T. Tyson in Southern Maryland. In both localities their remains are mingled with those of Dolphins and Whales, and their carcases have all floated together on the ocean currents and tides to their present resting places. In Europe there are some species of the same genus, while allies of the true crocodilian form represent the Plerodon of Meyer. The gavials of the Cretaceous present a similar character of teeth, and approach remarkably near to the Thecachampsæ, when we consider the great hiatus between the life of the two great periods in other departments. The gavials of the Miocene differ in but a few important points from the Thoracosauri of the Cretaceous. The latter were very numerous in individuals, and appear under five specific forms.

In the plate accompanying this article, the artist has attempted an ideal representation of a few of the subjects which haunted the shores of our country, when our prairies were the ocean bottom, and our southern and eastern borders were far beneath the Atlantic. *Lælaps aquilunguis* occupies the foreground on a promontory, where his progress is interrupted by the earnest protest of an *Elasmosaurus*. *Mosasaurus* watches at a distance with much curiosity and little good will, while *Osteopygis* views at a safe distance the unwonted spectacle. On the distant shore a pair of the huge *Hadrosauri* browse on the vegetation, squatting on their haunches and limbs as on a tripod. *Thoracosaurus* crawls up the banks with a fish, and is ready to disappear in the thicket.

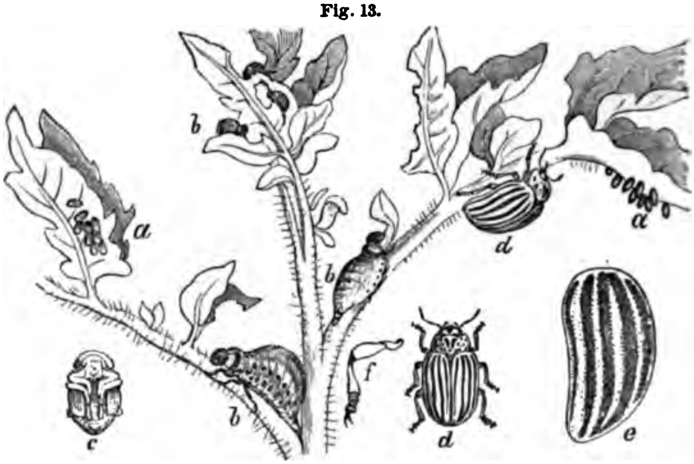
INSECTS INJURIOUS TO THE POTATO.

BY HENRY SHIMER, M. D.

Of the several distinct species of potato bugs, the Colorado Beetle (*Doryphora 10-lineata* Say, Fig. 13; *a*, eggs; *b*,

young and fully grown larvæ; *c*, pupa; *d*, beetle; *e*, left wing cover, magnified; *f*, leg, magnified) has chiefly attracted attention at the West during the few years past. It has been very destructive, hence anything bearing upon its habits is

Fig. 13.



interesting to farmers. Last year they were more numerous in Illinois than at any other time. Whole acres were entirely destroyed by them. The autumn following the early frosts that killed the potato vines, was one of the finest we ever enjoyed. This unusually late pleasant weather induced the pupæ of the last brood of the Colorado Beetle to mature and come out of the ground instead of remaining in over winter, and the lack of food in the fall, together with the cold open winter, contributed greatly to their destruction. From this one can easily see their assailable points, and devise means for holding them in check. It is manifest that this can be done most effectually by the concerted action of the farmers of the whole country. I think it needs no argument to prove that it would be better for the entire North-west, so far as the Colorado Beetle has extended, to abstain from planting potatoes for one year, than to be annoyed as they have been in Iowa and Illinois during the few past years. Or, perhaps, it might be as effectually managed by planting only early-

maturing varieties; planting these early one year, and digging the potatoes in August; then in the following year farmers might plant about the first of July, and take them up after the frost kills the vines. By this course of treatment these potato bugs will be without food during the first fall, and many will perish, while those that remain in the ground over winter will come up in May, and be without food more than a month in the spring, and thus perish. This plan rigidly followed will restrain, if not exterminate the bug.

To this argument some may reply that the potato bug will feed on other species of the natural botanical family Solanaceæ, such as the tomato, thorn-apple, etc. It is true that they will eat of these to some extent, especially the hungry half-grown larvæ, but I have observed carefully, and never in this region saw the young potato bugs developing from the eggs laid on these plants, though I have occasionally seen eggs on tomato plants.

Early in the last spring a sufficient number of mature potato bugs appeared on the potato vines to cause some apprehensions of trouble, though much less than in the preceding year. The larvæ appeared as usual, and early potatoes were partially trimmed by them, from which I inferred that the second brood would do a good deal of damage in July and August.

About the middle of July I saw potato bugs in Minnesota, as far north as St. Paul. They were quite abundant, the larvæ stripping the vines as they had done in Illinois last year. I was at home in Illinois in August, and sought for the potato bugs on the same grounds that were entirely overrun by them last year, and found very few. At the last of August, I searched in the potato patch, on these same grounds, and found but two mature bugs and one small bunch of eggs. Here is a remarkable and unexpected decrease of bugs, instead of the usual increase, that makes them very destructive in August. How are we to account for it? The various known heteropterous enemies, and Lady-birds,

(Fig. 14, *Coccinella 9-notata* and pupa; fig. 15, *Hippodamia 13-punctata; a*, larva; *b*, pupa) without doubt destroyed some, but as I could not find them more numerous than usual, I cannot admit that they were the chief means of this almost perfect extermination of potato bugs. Moreover the larvæ in June were sufficiently numerous, in proportion to the number of beetles observed in the spring, and yet in July and August the beetles failed to appear as expected. We can only look to climatic causes as the principal means that prevented the spring brood from maturing.

Fig. 14.

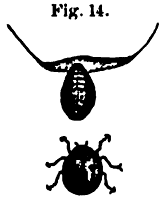
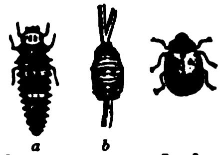


Fig. 15.



The weather here was uncommonly *hot* as well as dry, hence the pupæ were exposed to the burning dry dust, and this doubtless was the efficient cause of the death of the soft, naked, delicate pupæ. The only object that they can have in entering the ground to transform, is protection from the hot dry atmosphere of summer and the cold frosts of winter, for they will transform well enough above ground in a pasteboard box in a room, as I proved in hundreds of examples during the series of observations I made on the breeding of these insects in 1865, and reported in the "Practical Entomologist." The ground usually furnishes a cool moist place, but this time it failed to favor them, hence they perished.

I have often observed that the pupæ of various insects perish from exposure to too much evaporation. The pupæ of the various wood-borers however, carefully handled, will not develop so well in a paper box as in the hole they make in the tree, and many of them dry away entirely; this I have often observed, and very forcibly this summer, in the examples of the new species of beetle, that I have bred from the prickly ash tree; also the three varieties of beetles, bred from the several borers, or "grubs," found in the grape-vine, reported to the Academy of Natural Sciences, Philadelphia. This same drying away of the pupa I have often noticed

in attempting to breed the Maple Worm (*Dryocampa rubicunda*). The larva retires to some cool moist place beneath a board, stone, or anything it can find on the ground, where it will not be exposed to the dry atmosphere, for the chrysalis is naked. Now take this same chrysalis and put it into a dry box, and it most likely will perish, and fail to perfectly develop. Many lepidopterous larvæ protect themselves with an impervious cocoon where they are exposed to atmospheric vicissitudes. This, I believe, is not only to protect them from the rain, if it is at all for this purpose, as entomologists often suppose, but to protect them from the far more injurious influence of evaporation during the long time they take no liquid nourishment. It is for this purpose also that the Cecidomyian larva cements its spun cocoon with a gummy fluid, as I have shown in the "Transactions of the American Entomological Society," for October, 1867. We therefore find here another example of climatic causes, producing disease and death among insects in a wholesale manner.

Entomological writers usually represent cannibal insects as the most efficient means in nature for the extermination of injurious insects, and in the reports of State Entomologists we occasionally find them speaking in glowing terms of the power that man can exert in controlling injurious insects. While we may not despise these measures of protection, especially the former—for without the Ichneumon fly, the Syrphus fly, the Coccinellæ, etc., we would doubtless be overrun by swarms of caterpillars, plant-lice, and other noxious depredators—let us not forget the great truth, that climatic causes, producing death by epidemic diseases and various other means, are infinitely in advance of most other natural means of exterminating noxious insects (for my extended views and observations on this topic, see an address before the Northern Illinois Horticultural Society, and published in the first volume of the Transactions of that body, and my Report of a remarkable epidemic disease observed among

Chinch-bugs, in the Proceedings of the Academy of Natural Sciences of Philadelphia, for May, 1867).

Fig. 16.

In the case of the Chinch-bug, the conditions favoring its development and health are entirely the reverse. It was during the unusually wet weather of 1865 that the great epidemic referred to prevailed, and at the same time the Colorado potato bug flourished and multiplied as favorably as it could desire; but this year was one favorable to the development of the Chinch-bugs, and true to nature, they have increased so that a few can be found again. Since I observed this failure of development among the potato bugs, I have looked carefully for them in this (Carroll) and parts of the adjoining counties, and seldom find a patch with any bugs. At this date the early frosts have already killed the potato vines, hence their autumnal supply of food being cut off we may expect a still more complete destruction of the bugs if the next autumn should be nearly as pleasant as the last.

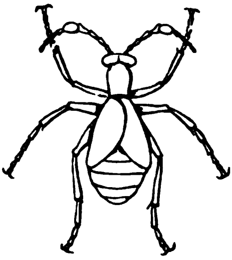
Fig. 17.

Fig. 18.

Of the Blistering Beetles (*Cantharidæ*), I have observed this year the Striped Cantharis (*Lytta vittata* Fabr., Fig 16) unusually abundant, and quite injurious to potato vines, beet leaves, etc. The Margined Cantharis (*Cantharis marginata* Oliver, Fig. 17) were also moderately abundant, injuring beets most. I also observed some of the Ash-colored Cantharis (*Lytta cinerea* Fabr., Fig. 18, *a*, male), and the black Cantharis (*Lytta murina* Leconte, Fig. 18, *b*) on potatoes and beets. A species of Oil Beetle (*Meloë angusticollis*, Fig. 19) was also abundant, eating potatoes, beets, etc., and injuring tomato fruit very much. Farmers all about

this region have complained bitterly of a "new long potato bug," alluding to these Cantharides, having forgotten in the midst of the injuries caused by the Colorado potato bugs for several years, that these blistering beetles had ever injured potato vines.

Fig. 19.



The reports coming in from localities all around me were that these Cantharides were much more injurious than the Colorado bugs; that potatoes were greatly injured, and beet crops entirely ruined in many instances; and this accords with my observations about home.

These Cantharides are not very particular about the choice of food. Although they doubtless prefer the potato, beet, golden-rod, etc., yet sooner than be without food, they will devour almost any kind of vegetable that comes in their way. I have seen the Ash-colored Cantharis doing well on locust leaves; also on common red field clover, etc., and have lately, for a wonder, seen the Black Cantharis feasting on the leaves of a common noxious weed, sometimes called lamb's quarters, pig-weed, etc. (*Chenopodium album* Linn.), for injurious insects are almost sure to eat the useful vegetation in preference to weeds.

After thus observing the workings of nature's plans, I am convinced that she will in due time take care of the Colorado potato bug, as she has of the Cantharides during all past time.

NOTE.—Since communicating the above, I spent two weeks last autumn in travelling in Eastern and Middle Iowa, and learned some facts, the most reliable being developed out of the history of the general good potato crop, as evinced by the price in the digging season. Potatoes at Mount Carroll, Ill., were 50 cents a bushel; at Morseville, Joe Davis County, Ill., 50 cents; at Rock Island, Ill., 60 to 70 cents. In Iowa, at South Amenon, 30 to 35 cents; at Marengo, 50 cents; State Centre, 30 to 35 cents; Grundy County, 25 to 30 cents; and thus prices ranged all along wherever I went. The Colorado potato beetle had been very injurious.

All through these places for several years farmers all were discouraged with attempting to raise potatoes, and therefore did not plant largely; some abandoned the crop in disgust. The above figures I obtained from parties buying and selling, and learned from them that potatoes were abundant.

I invariably inquired of farmers regarding the Colorado potato beetle. They all knew it very well, but explained the cause of its diminution, by supposing that it had passed by them, travelling north and east; forgetting that insects travel in search of food and breeding grounds, and not to make money, see the country or their friends, or for any other pleasure, as does the human animal. They all knew that the bugs were plenty in the spring, but not in midsummer and autumn. As this peculiar phenomenon in the history of the Colorado potato bug was the same as above noted at my home, I am persuaded that it was due to the same cause, in a slight degree to insect enemies, but chiefly to climatic causes, *i. e.*, the *hot dry weather*.

I am now convinced beyond a doubt, that the dryness of the summer was the only efficient restraining cause, although my friends Messrs. Walsh and Riley differ entirely from this view. See the "American Entomologist," (Vol. I, Nos. 2 and 3) where they figure quite a host of the enemies of the Colorado potato bug, some of which are inserted in the present article, but do not even notice the great climatic enemy that worked so faithfully and effectually everywhere during the past summer.

Fig. 20.

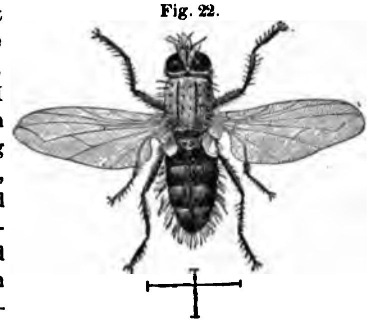
I appreciate with much gratitude the small part of the work done by these "bug foes," and I hope that the editors and authors will excuse a passing review. Lady-birds doubtless eat the eggs of some potato bug, but many such reports came to my ears through farmers and agriculturists and were not at all reliable. Unfortunately, as I have observed, Lady-birds will devour Lady-bird's eggs about as frequently as any other eggs, and none but entomologists observe the difference, hence I seldom notice such reports, at least in print, without personal investigation. The Many-banded Robber (*Harpactor cinctus* Fabr., Fig. 20) will not do much work, for, although they will eat some larval potato bugs (just as a cat will eat some bread) when hard pressed for food, yet they will perish of hunger when confined in a box with young Colorado potato bugs, as I have demonstrated, thus proving that they must have other and better food. The very same, probably, may be true (reasoning from analogy) of their other principal heteropterous enemy, the Spined Soldier-bug (*Arma spinosa* Dallas, Fig. 21; *a*, its beak; *c*, the beak of the *Euschistus punctipes* Say, which closely resem-

Fig. 21.

bles the *Arma*). This, however, I never have subjected to the crucial test of boxing up with the beetle, but have never seen it feeding on them in nature, nor found them more abundant in potato patches than elsewhere.

The authors, from their correspondents, publish as "no doubt indisputable," that the Blister Beetles frequently feed on potato bugs. This same idea entered my head when I saw the potato bugs so scarce, and the blister beetles, especially the striped one, so very abundant on our potatoes. To test it, I put a few Striped Blister-beetles into a breeding jar, with one small bunch of potato bug eggs (all I could find) and a potato stalk for food. The eggs hatched in a day, and the young Colorado bugs lived in harmony among their "formidable" associates, until the potato vine moulded away. The Blister-beetles perished first, of starvation, without destroying one of the larvæ. This little experiment, although not as extended as I could wish, yet inclines me to be skeptical about the matter. Their parasitic fly (Fig. 22, *Tachina*) is entirely new to me, and I hope is a more important enemy than all the others. While I was breeding great numbers of potato bugs in 1865, preparatory to the paper I published in 1866, in the "Practical Entomologist," on this subject, I failed to find anything of this kind here; since then I have not searched for it. Their paper is full of interest, yet to the practical man does not give very much substantial encouragement except in recommending the old-fashioned tedious way of picking the bugs by hand, as in reality this is about all man can do.

Fig. 22.



Before closing this already long note, allow me to place among the list of insect enemies a *Philonthus* which is undescribed, according to Mr. Walsh, who received the specimen from me. This specimen, in the summer of 1865, I found as an intruder in one of my breeding boxes, containing a number of Colorado potato bug larvæ. When found, it had maliciously killed all the larvæ, just as a weasel or mink will kill more chickens than it needs for food. This insect was a medium sized member of the family *Staphylinidæ*, a *Brachelytrous* beetle. It was black, with short wing-cases. This fierce and powerful insect, individually, is the most terrible enemy of the Colorado potato bug extant among insects, and I hope that some day it will be honored with the name of the Prairie State, with credit for an efficient worker.

NOTE.—Cuts 13, 15, 16, 17, 18, 20, 21 and 22, are from the "American Entomologist."

REVIEWS.

The Pampas and Andes.* — When one considers that this pedestrian feat was performed by Mr. Bishop when only seventeen years old, unaided by influential friends, having no money, and no knowledge of the language, and for a time sustaining himself by his own labor, one must confess an admiration for the boy's pluck. A perusal of the book shows how one will brave a thousand dangers when impelled by a love of nature. Many interesting facts are given regarding the habits of the natives, the physical features of the country, etc. Some errors which have found their way into our text books are corrected. We find, for instance, that no such place as Uraguay is known in South America. The province, incorrectly called Uraguay on our maps, is properly called Banda Oriental. An interesting account is given of a species of marmot, which burrows in the pampas as our prairie-dog does in the West. "Its habits are similar to those of the proper marmots; in size it exceeds the opossum of North America." They are found all over the pampas, as far south as Patagonia. And strangely enough the burrows are occupied by a small owl known by the name of the Burrowing owl of South America. As an account has already been given in the Naturalist of the Burrowing owl of the West, we subjoin Mr. Bishop's account of the companion species in South America:

"I first met with this owl on the banks of the River San Juan, in the Banda Oriental, one hundred and twenty miles west of Montevideo, where a few pairs were observed devouring mice and insects during the daytime. From the river, travelling westward thirty miles, I did not meet a single individual, but after crossing the Las Vacas, and coming upon a sandy waste covered with scattered trees and low bushes, I again met with several.

"Upon the pampas of the Argentine Republic they are found in great numbers, from a few miles west of Rosario, on the Parana, latitude 32° 56′ south, to the vicinity of San Luis, where the pampas end, and a travesia or saline desert commences.

"On these immense plains of grass it lives in company with the *bizcacha*. The habits of this bird are said to be the same as those of the species that inhabits the holes of the marmots upon the prairies of western North America. But this is not strictly correct, for one writer says of the northern species, 'we have no evidence that the owl and marmot habitually resort to one burrow;' and Say remarks that 'they were either common, though unfriendly, residents of the same habitation, or that our owl was the sole occupant of a burrow acquired by the right of conquest.' In this respect they differ from their South American relatives, who live in perfect harmony with the *bizcaha*, and during the day, while the latter is sleeping, a pair of these birds stand a few inches within the main entrance of the burrow, and at the first strange sound, be it near or distant, they leave their station, and remain outside the hole, or upon the mound which forms the roof of the domicile. When man approaches, both birds mount above him in the air, and keep uttering their alarm note, with irides dilated, until he passes, when they quietly settle down in the grass, or return to their former place.

"While on the pampas, I did not observe these birds taking prey during the daytime, but at sunset the *bizcachas* and owls leave their holes, and search for food, the young of the former playing about the birds as they alighted near them. They do not associate in companies, there being but one pair to each hole, and at night do not stray far from their homes.

* The Pampas and Andes. A Thousand Miles' Walk across South America. By Nathaniel H. Bishop. Lee & Shepard. Boston: 1869. 12mo.

"In describing the North American burrowing owl, a writer says that the species 'suddenly disappears in the early part of August,' and the 'species is strictly diurnal.'

"The *Athene cunicularia* has not these habits. It does not disappear during any part of the year, and it is both nocturnal and diurnal, for though I did not observe it preying by day on the pampas, I noticed that it fed at all hours of the day and night on the north shore of the Plata, in the Banda Oriental."

ONE THOUSAND OBJECTS FOR THE MICROSCOPE.* — This is an exceedingly useful little work for the beginner in microscopy. It has twelve plates of figures, with explanations in the text, and although the figures are none of the best, they are better than the price of the book would seem to justify.

A GUIDE TO THE STUDY OF INSECTS.† — The Fifth part completes the account of the butterflies, and describes the more typical moths, as far as the family of Geometrids. It contains two plates, a full-page illustration, and sixty woodcuts. The "Guide" will contain ten plates, and be completed in five more parts, the tenth part to contain an Entomological Calendar, a Glossary of Entomological terms, and a copious Index.

THE RECORD OF AMERICAN ENTOMOLOGY, 1869. — A sufficient number of subscriptions have been received to warrant its publication, but as the book will be larger than at first thought, the price will be raised to $1.00. Original subscribers at 75 cents, will receive their "Record" without extra charge. (The name has been changed from *Annual* to *Record*).

APPLETON'S ILLUSTRATED ALMANAC FOR 1869.‡ — A pleasing feature of this annual is twelve cuts, illustrating the game-birds of this country, characteristic of each month.

NATURAL HISTORY MISCELLANY.

BOTANY.

BOTANICAL NOTES. — In the autumn of 1867 I collected on the shore of Lake Erie, near North East, Pa., a very marked variety of *Scirpus sylvaticus* Linn., var. *atrovirens?*. Instead of spreading rays bearing the heads of spikes, as is usual in this species, the heads of the plants that I found were collected in a dense globular mass, about one inch in diameter. The rays were either very short, or there were none at all. The scales and fruit are similar to those of the common variety. This curious form was not the result of a dwarfing of the plants, for they were of a very robust habit, two to three feet high, with wide leaves and a stout culm. I propose calling it var. *sychnocephala* if not already named. I found them

* One Thousand Objects for the Microscope. By M. C. Cooke. 12mo. London, 1869. 1s.

† A Guide to the Study of Insects, and a Treatise on those Injurious and Beneficial to Crops. For the use of Colleges, Farm Schools and Agriculturists. By A. S. Packard, Jun. Parts 1-5. 50 cents each. To be published in ten parts. Published by the author, Salem, Mass.

‡ Appleton's Illustrated Almanac, 1869. For sale by H. A. Brown & Co., 3 School st., Boston.

growing a few feet from the edge of the water. Is this form found in other places?

I have collected from the same rootstock (I think) in two successive years, two specimens of *Trillium erythrocarpum* Mx., with pistillate flowers and nine petals. The extra petals took the place of the stamens, and were colored like the others, but were somewhat smaller in size.—S. N. COWLES, *Otisco, N. Y.*

THE CEDARS OF LEBANON.— Dr. Hooker makes the following interesting communication to a recent number of the "Gardeners' Chronicle":— "The Rev. M. Tristam, F. L. S., informs me of a most interesting discovery lately made in the Lebanon, *viz.*, of several extensive groves of cedar trees, by Mr. Jessup, an American missionary, a friend of his own, to whom he pointed out the probable localities in the interior. Of these there are five, three of great extent, east of 'Ain Zabalteh,' in the southern Lebanon. This grove lately contained 10000 trees, and had been purchased by a barbarous Sheikh, from the more barbarous (?) Turkish government, for the purpose of trying to extract pitch from the wood. The experiment of course failed, and the Sheikh was ruined, but several thousand trees were destroyed in the attempt. One of the trees measured fifteen feet in diameter, and the forest is full of young trees, springing up with great vigor. He also found two small groves on the eastern slope of Lebanon, overlooking the Buka'a, above El Medeuk; and two other large groves containing many thousand trees, one above El Baruk, and another near Ma'asiv, where the trees are very large and equal to any others; all are being destroyed for firewood. Still another grove has been discovered near Duma, in the western slope of Lebanon, near the one discovered by Mr. Tristram himself. This gives ten distinct localities in the Lebanon, to the south of the originally discovered one, and including it. Ehrenberg had already discovered one on the north of that locality, and thence northwards the chain is unexplored by voyager or naturalist."—*Quarterly Journal of Science, London.*

ZOÖLOGY.

THE CROW A BIRD OF PREY.—In confirmation of what Mr. Naumann has stated in regard to the crow as a "bird of prey," Mr. H. G. Bruckart, of Silver Spring, Lancaster County, stated before the Linnæan Society, of Lancaster City, at its January meeting, that in his neighborhood it is not an uncommon occurrence, and especially not in the spring of the year, when they have had a winter's fast, and hens take their young broods abroad. Indeed he has known them to venture into barn-yards, and carry off young chickens. We *know* that the corvine appetite craves the eggs of other fowls, and this characteristic is only a farther advance in that direction. We have now a formidable "Crow Roost" on the Conestogo, in this county, about six miles south of Lancaster City, but with their usual cunning, I have not yet learned that they "tease sheep near

home." The gentleman upon whose farm the "roost" is located, says they rise up every morning, and after forming four divisions, the one flies east, another west, another north, and another south, returning again in the evening. About the same number fly in these same directions, and about the same hours every day.—S. S. RATHVON.

HOW TO COLLECT MYRIAPODS.—The following letter from the late Mr. Newport of England, was written to his friend, Mr. Doubleday, of the same country. The latter had volunteered the services of Dr. T. W. Harris, with whom he had formed a close intimacy during his sojourn in this country, in collecting material to aid Mr. Newport in his studies upon the Myriapods. Mr. Newport was one of the highest authorities in this group. As it gives, in a familiar form, the more important directions necessary for collecting Myriapods (Centipes, etc.), we publish it hoping to call attention to these interesting animals. Those who wish to study our native species, are referred to the papers of Dr. Wood, in the Proceedings of the Academy of Natural Sciences of Philadelphia, and in the Transactions of the American Philosophical Society, 1865.

10 UPPER SOUTHWICK STREET,
CAMBRIDGE TERRACE, Dec. 22, 1842.

MY DEAR SIR:—In accordance with your suggestion, I now send you a few observations respecting those Myriapods which I so much desire to possess. You are aware that I should be delighted to obtain any specimens of Myriapods from the United States, and that the *localities* being added would make them much more valuable. I would suggest that instead of drying the specimens, the whole be preserved in strong spirit, as a great many may be stowed away in that manner without receiving any injury, and can afterwards be dried, if required, as specimens for the cabinet. As far as my own wishes are concerned, I would much prefer all specimens in spirit, and should be greatly obliged by having as many specimens, even of the same species, as can be collected. There cannot be too many, especially of the true *Scolopendra*, *Cermatia*, *Lithobii*, *Glomeridæ* and *Polydesmidæ* [Fig. 23, *Polydesmus erythropygus* Brandt]. The last two of these families, owing to the great hardness and impenetrability of their tegument, do not preserve well, unless the spirit can be made to enter their interior. I would suggest, therefore, that every specimen of these two families, as well as of the true *Juli* [Fig. 24, *Julus multistriatus* Walsh] and the *Cermatia*, or Shield-bearers, be once or twice pierced with a strong needle in the middle and posterior parts of the body, to allow the spirit to enter. They would then be well preserved and fit for an examination of their interior anatomy, which is my object in obtaining many specimens of the same species. If I understood you rightly, the *Cermatia* are very common in America. I am exceedingly glad, as I cannot yet

Fig. 23.

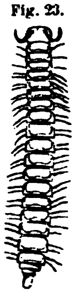
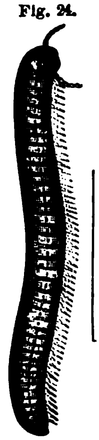


Fig. 24.



obtain any of these specimens for dissection. I am not aware whether any of the large Glomeridæ, the proper Sphærotheridæ of Brandt, are found in America, as I should expect they might be. These would be

Fig. 25.

very desirable. You are quite aware that young and immature specimens are often found more easily, and in greater numbers, than the full grown and more perfect specimens. This is especially the case with the Myriapoda, which often swarm in the immature state under the rotten bark of trees or felled timber. Now these *very young* specimens, of all species, are too much neglected by naturalists, and I am particularly desirous of obtaining them. I would recommend that a large quantity of the *very smallest Scolopendra* [Fig. 25, *Scolopocryptops 6-spinosa* Say; from Iowa], Scutigeridæ or *Cermatia*, Polydesmidæ, Cryptops, and Juli be collected. If your friend Mr. Harris could obtain them for me, I should feel greatly obliged. The state in which these species are most interesting to me is when they do not exceed *one-fourth* or *one-half of an inch* in length. My usual mode of collecting the young Lithobii, of this country, is to have one or two phial bottles filled with rectified *spirits of wine*, and when I see any of the little mortals running away and about to give one *leg bail*, just to wet my finger with saliva and place it upon them, when, of course, they adhere to it and are easily washed off by placing my finger on the mouth of the phial and shaking the spirit against it; or by washing the finger in the spirit itself. If your friend, by chance, should meet with any eggs of the Shield-bearers, or other genera, they would be very desirable, and would, I have no doubt be perfectly preserved in phials filled with light mould. The young *Scolopendra*, or *Lithobius* [Fig. 26, *L. Americanus* Newp.], or *Cryptops*, or Scutigeridæ, must not be put together *alive* in the same phial, as they destroy each other, but the large *Scolopendra* may be preserved alive, singly, in wooden boxes, with moistened earth, for several weeks, especially if the earth be impregnated with animal matter. I should be very glad to obtain the *Polydesmus Virginiensis* of Drury (*Fontaria Virginiensis* of Gray), and all of these species may be placed together in tin or wooden boxes, without injuring each other, if, supplied with some vegetable mould, rotten leaves, or bark. As a general rule, all the true Chilognatha may be placed together, but the Chilopoda, with the exception of the Geophili, destroy each other. The Geophili [Fig. 27, *Geophilus bipuncticeps* Wood; from Iowa] I preserve in bottles with vegetable mould and rotten bark, enclosing the mouth of the phial with a piece of bladder,

Fig. 26.

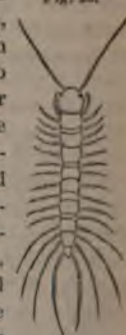


Fig. 27.

which keeps the specimen secure, and at the same time admits sufficient air for respiration. In this way I have preserved Geophili in the same phial with Juli for many months, and it is better than closing the bottle with a cork.

I think, my dear sir, I have now given you a pretty good list of my desiderata, but I would also, just add, that a collection of Scorpions and Phalangidæ would be equally acceptable. Of these things, as well as of the Myriapods, I would suggest that the very smallest, as well as the very largest specimens of the same species, be collected and preserved in the same way in spirit. In all cases, if the weather be warm, the spirit should be changed when the specimens have been in it for about a month, otherwise they may become rotten and unfit for dissection.

With many thanks for your kindness, I remain, dear sir,

Yours, faithfully,

E. DOUBLEDAY, Esq. GEORGE NEWPORT.

ON THE DRUMMING OF THE RUFFED GROUSE.*—A writer in "Harper's Magazine" for October, in an article which he heads "Our neighbors the Birds," in speaking of the drumming of the ruffed grouse, says: "the bird resorts to a fallen trunk of a tree or log, and while strutting like a male turkey, beats his wings against his *sides* and the *log* with considerable force."

It is a strange thing that a writer who seems to be familiar with birds should make such a statement. He is not singular, however, in this matter, for most if not all writers whose statements I have examined, seem to be of opinion that the drumming is produced by beating the log or their bodies with their wings; neither of which operations could possibly produce the *hollow* sound which the bird produces. I have not access to Audubon's works, and do not know his opinion. So good an observer as he was is not likely to be mistaken in the matter, and I should like to know his opinion.†

The writer in Harper is mistaken when he says the grouse drums while strutting, like a turkey. He stands perfectly still and erect, stretching himself as high as possible, and produces the drumming sound by striking the *convex surfaces* of his *outstretched wings together behind his back*, just as you often see boys swinging their outstretched arms behind them, so as to make the backs of their hands meet behind, and opposite the spine. This is the truth and the whole matter.—Dr. RUFUS RAYMOND, *Brookville, Ind.*

* Communicated to the Smithsonian Institution.

† Audubon, on page 216 of Vol. I of his Ornithological Biography, says, "The drumming is performed in the following manner: The male bird, standing erect on a prostrate decayed trunk, raises the feathers of its body in the manner of a turkey-cock, draws its head towards its tail, erecting the feathers of the latter at the same time, and raising its ruff around the neck, suffers its wings to droop, and struts about on the log. A few moments elapse, when the bird draws the whole of its feathers close to its body, and stretching itself out, beats its sides with its wings, in the manner of the domestic cock, but more loudly, and with such rapidity of motion, after a few of the first strokes, as to cause a tremor in the air not unlike the rumbling of distant thunder."—EDITORS.

Hatching of the Seventeen-year Cicada.—With reference to the eggs and young of the Seventeen-year Cicada, your correspondent from Haverford College, Philadelphia, is not the only one who has failed to produce the young, by keeping branches containing eggs in their studios. I so failed in 1834 and 1851, and indeed I have never heard that any one has succeeded in that way, who has kept them for any great length of time. In the brood of 1868, the first Cicadas appeared here in a body, on the evening of the 2d day of June. The first pair *in coitu*, I observed on the 21st, and the first female depositing on the 26th of the same month. The first young were excluded on the 5th of August. All these dates are some ten days later than corresponding observations made by myself and others in former years. On the 15th of July I cut off some apple, pear and chestnut twigs containing eggs, and stuck the ends into a bottle containing water, and set it in a broad shallow dish also filled with water, the whole remaining out of doors exposed to the weather, whatever it might be. The young continued to drop out on the water in the dish, for a full week, after the date above mentioned. I could breed no Cicadas from branches that were dead and on which the leaves were withered, nor from those that from any cause had fallen to the ground, and this was also the case with Mr. Vincent Bernard, of Kennet Square, Chester County, Pa. After the precise time was known, fresh branches were obtained, and then the young Cicada were seen coming forth in great numbers, by half a dozen observers in this county. As the fruitful eggs were at least a third larger than they were when first deposited, I infer that they require the moisture contained in living wood to preserve their vitality. When the proper time arrives and the proper conditions are preserved, they are easily bred, and indeed I have seen them evolve on the palm of my hand. The eyes of the young Cicadas are seen through the egg-skin before it is broken.—S. S. Rathvon, *Lancaster, Pa.*

Preparation of Bird's Eggs.—The season for collecting eggs has now commenced, and it may be of interest to those engaged in oölogy to know the best method of preparing the egg for the cabinet. As a writer in this journal (Vol. II, p. 487) has gone somewhat into detail on this subject, I will only add the more recent improvements in this branch of Natural History. Until within a few years eggs were blown with two holes, one at each end, or two holes in the side, as seen in the drawing on p. 487, Vol. II. Now, oölogists desire the egg blown with only one hole, and that on the side. This is the only way now adopted by our best collectors. By placing the hole downward nothing but the perfect egg is visible; or what is still better, place the number (according to the Smithsonian Catalogue) over the hole, with the number in sight; then every person, whether familiar with oölogy or not, can tell the egg by referring to the catalogue. The common blowpipe is generally used to remove the contents of the egg. If the hole is a little larger than the point of the blowpipe, the inside passes out around the instrument. If the aperture is no larger than the point, by forcing air into the egg, and

withdrawing the pipe, a part of the contents will follow, and by repeating the process several times you can empty the shell. Then fill the blowpipe with water and force it into the shell several times, shake it well, and then blow out the water; repeat it until it is perfectly clean. Be very particular, especially with white eggs, or dark spots will appear after a time, which make the egg worthless. It was while I was blowing a box of about one hundred eggs of Wilson's Tern (*Sterna Wilsoni*) that Mr. Ellsworth suggested to me a new invention for blowing them. The result is, I can now prepare one hundred eggs in less time than I formerly could ten, and much better, doing all the work with my hands that heretofore has been a severe tax upon my lungs. I will not now describe the instrument, but will say, in brief, that it is invaluable to the oölogist. I would not part with mine for ten times the cost ($3.10) if I could not replace it. This is the testimony of all who have used them. If any collector wishes to obtain this valuable instrument, the inventor, Mr. E. W. Ellsworth, of East Windsor Hill, Connecticut, will supply them. —WM. WOOD, *East Windsor Hill, Conn.*

THE VISION OF FISHES AND AMPHIBIOUS REPTILES.—M. F. Plateau has advanced the theory "that these animals can see distinctly in the air, and that their distance of distinct vision must be nearly the same in this medium and in water. Although fishes, with the exception of some privileged species, such as the Eel, the Chironectes, and the Climbing Perch, have hardly any need for combining the faculty of seeing distinctly in water with that of seeing distinctly in the air, this double faculty is evidently indispensable to the Amphibia."—*Annals and Magazine of Natural History.*

FLIGHT OF BIRDS.—Will you inform us how sailing birds remain suspended in the air? Last summer while standing with Prof. Mudge, on the high bluff of the Kaw, opposite Manhattan, Kansas, a large bird, supposed to be *Cathartes aura*, rose from the opposite margin of the river, and accomplished a spiral flight of over five minutes duration, supposed to be more than five hundred feet in height, and a mile in linear extent, against a wind blowing about "three" on the Smithsonian scale, without flapping his wings but *once*, and that was apparently to preserve his balance.

The following suggestions have been made: 1. Birds in sailing do not rise above the initial point, but use their wings as parachutes, like the flying squirrel. The turkey buzzard, mentioned above, rose about three times as high as the bluff. 2. Extended sailing like this is due to the momentum gained by previous flight. The turkey buzzard in this case rose from a perch at the river's brink. 3. Short quills under the wings are used, while the wings proper are stationary! 4. Birds sail against the wind like ships. The resultant force of the sail and keel may be resolved into two forces, one lying in the line of direction of the ship's path. How with birds? Do not sailing birds accomplish the spiral flight when the air is comparatively still? 5. The air raised to a temperature

of 103° Fahr. by the heat of the bird, fills the quills, hollow bones and cavities of the body, and buoys it up. Shoot a hawk or buzzard while sailing, and down he tumbles from his airy perch. Does his body cool as soon as that?

Not one of these suggestions seems to be sufficient. Do they when combined? Will you please enlighten us?—JOHN D. PARKER, *Topeka, Kansas.*

DEEP-SEA DREDGING NORTH OF SCOTLAND—Drs. W. B. Carpenter and Wyville Thompson report to the Royal Society that the recent dredging expedition to the Farœ banks has "obtained evidence of the existence, not of a degraded or starved out residuum of animal life, but of a rich and varied fauna, including elevated as well as humble types, at a depth of 530 fathoms." "Their researches have conclusively established the existence of a temperature as low as 32° over a considerable area of sea bottom, where the depth was 500 fathoms and upwards, notwithstanding that the surface-temperature varied little from 52°." They argue that there is a stratum of sea water with a temperature of 32°, or even 28°, and the existence of such strata even in equatorial regions, has been regarded by high scientific authorities as proving the existence of deep currents, bringing cold water from polar regions to replace the warmer water that is continually flowing as (notably) in the Gulf Stream, from the equatorial towards the polar regions, as well as to make good the immense loss which is constantly taking place by evaporation from the surface of tropical seas." "The examination which Prof. Huxley has been good enough to make of the peculiarly viscid mud brought up in our last dredging at the depth of 650 fathoms, has afforded him a remarkable confirmation of the conclusion he announced at the recent meeting of the British Association, that the Coccoliths and Coccospheres are embedded in a living expanse of protoplasmic substance, to which they bear the same relation as the *spicules* of sponges or of *Radiolaria* do to the soft parts of those animals. Thus it would seem that the whole mass of this mud is penetrated by a living organism of a type even lower, because less definite, than that of sponges and *Rhizopods*; and to this organism Prof. Huxley has given the name of *Bathybius*. This calcareous mud, composed partly of these bodies and partly of living *Globigerinæ*, has been compared to the great chalk formation, and the reporters thus compare the animals found living in it with the marine fauna of the Cretaceous period:—

"Among Mollusca we have two *Terebratulidæ*, of which one at least (*Terebratulina caput-serpentis*) may be certainly identified with a Cretaceous species, whilst the second (*Waldheimia cranium*) may be fairly regarded as representing, if not lineally descended from, another of the types of that family so abundant in the Chalk. Among *Echinoderms* we have the little *Rhizocrinus*, that carries us back to the *Apiocrinite* tribe, which flourished in the Oolitic period, and which was until lately supposed to have had its last representative in the *Bourgetticrinus* of the Chalk. Among zoophytes, the *Oculina* we met with in a living state seems generically allied to a Cretaceous type (*O. explanata* of Michelin), and the remarkable abundance of sponges, which not improbably derive their nutriment from the protoplasmic substance that enters largely into the composition of the calcareous mud wherein they are embedded, is a pre-eminently conspicuous feature of resemblance. It can scarcely be doubted that a more sys-

tematic examination of the remarkable formation at present in progress would place in a still stronger light the relationship of its fauna to that of the Cretaceous period; since the specimens which our few dredgefuls contained can only be considered as a mere sample of the varied forms of animal life which this part of the ocean bottom sustains,—its 'Urschleim' being both physically and physiologically the foundation of the whole."

The authors also refer to deep sea forms found in the Mediterranean:

"That bivalve and gasteropod molluscs, as well as zoophytes, can exist at depths even exceeding that just named, has been clearly proved by the remarkable observation of M. Alphonse Milne-Edwards (which does not seem to receive the attention it merits), that when the submarine telegraph cable between Sardinia and Algiers was taken up some years since for repairs, several living polyparies and molluscs were attached to portions of it which had been submerged to a depth of from 1093 to 1577 fathoms. Of these, some had been previously considered very rare, or had been altogether unknown, whilst others were only known in a fossil state, as belonging to the fauna of the later tertiaries of the Mediterranean basin."—*Scientific Opinion.*

Honey Bees killed by Pollen.—In an article in the Naturalist for February on "Honey-bees killed by Silk-weed Pollen," you say "we have never before heard of an insect actually losing its life from this cause." In 1860 my attention was called to the same fact; many hives had their stocks seriously reduced from this cause. On a single specimen I counted over one hundred pollen masses attached to the claws and legs. When the claws are thus fettered, the bee cannot climb upon the combs nor collect honey, and is soon expelled from the hive and must die. The unfettered bees tumble them out with little ceremony. As the common silk-weed (milk-weed we call it here) needs insect aid to free its pollen masses, and thus secure the fertilization of the stigma, there are peculiarities in the structure of the flower to secure this result; and for this purpose the pollen masses are attached to a *cleft* gland. When the insect visits the flower to secure its honey, of which there is an abundance, it must step or the gland to reach the nectary, and a hair or claw entering the cleft becomes fast. To free itself the insect must pull out the gland with the pollen attached or remain and die; and the latter is really the fate of many small flies and moths.—J. Kirkpatrick, *Cleveland, Ohio.*

Lingula found living in California.—Mr. Tryon announced that Dr. W. Newcomb had dredged at Monterey, California, one living specimen of *Lingula albida* Sowb., which is probably the northern limit of the species, and not in accordance with the general rule of distribution.—*Proceedings of the Conchological Section of the Philadelphia Academy of Natural Sciences.*

GEOLOGY.

Prehistoric Pictures of the Cave Horse in France.—Prof. Owen states that outlines of the head of different individuals of the cave horse when alive, neatly cut on the smooth surface of a rib of the same species, have been discovered by the Vicomte de Lastic St. Jal, in 1863, in his cavern at Bruniquel, under circumstances which indisputably showed the work to have been done by one of the tribe of men inhabiting the cavern, and slaying the wild horses of that locality and period for food.—*Scientific Opinion.*

MICROSCOPY.

Amœboid movements in Eggs.—Prof. E. Van Beneden, in some very important researches on the development of the eggs of the lower crustacea, states that there is no vitelline membrane in the egg as it lies in the ovary. He proves it, first, by the amœboid movements already known of other eggs, and which he has observed to be particularly active in these instances; secondly, by the very interesting fact, of his own discovery, that the eggs at this stage, like the Infusoria, swallow, so to speak, globules of carmine. The same fact has been recorded with regard to the white blood corpuscles and other young cells."—*Schwann, in Scientific Opinion.*

The Molecular Origin of Infusoria.—The doctrine of Heterogeny, or spontaneous generation, seems to be slowly gaining adherents. Prof. R. Owen has declared in favor of it, and Dr. J. H. Bennett, the eminent pathologist of Edinburgh, advocates it in the "Popular Science Review" for January, under the title given above. He states that animals and plants are developed from ova or seeds, or by parthenogenesis, or by heterogenesis, *i. e.*, from molecules which compose the scum or pellicle seen on the surface of an infusion of any vegetable or animal substance. These molecules "constitute the primordial mucous layer of Burdach, and the proligerous pellicle of Pouchet. These molecules enlarge, and may be seen here and there strongly adhering together in twos and fours, so as to form a little chain." They continue to unite until they form a short staff, or filament—*bacterium.* These bacteria become longer by uniting with others, and have a serpentine movement whereby they are propelled forward in the fluid, forming a *vibrio.* These bodies disintegrate, and thus a second molecular mass is produced. "In this, rounded masses may be seen to form, which strongly refract light not unlike pus corpuscles, or the colorless corpuscles of the blood. These soon begin to move with a jerking motion, dependent upon a vibratile cilium attached to one of their extremities—*Monas lens.* In a day or two other cilia are produced, the corpuscle enlarges, is nucleated, and swims through the fluid evenly. Varied forms may now occur in the molecular mass, dependent on the temperature, season of the year, exposure to sunlight, and nature of the infusion, all having independent movements. They have been denominated *Amœbæ, Paramecia, Vorticellæ, Kolpoda, Keronæ, Glaucoma, Trachelius,*" etc., etc. "At other times it happens that the molecular mass, instead of being transformed into animalcules, gives origin to minute fungi," such as *Torula, Penicillium,* etc. "In all these cases no kind of animalcule, or fungus, is ever seen to originate from preëxisting cells or larger bodies, but always from molecules."

"That the infusoria originate and are developed in the molecular pellicle which floats on the surface of putrefying or fermenting liquids, has been admitted by all who have carefully watched that pellicle with the

microscope, more especially by Kutzing, Pineau, Nicolet, Pouchet, Jolly and Musset, Schaffhausen and Mantegazza." He holds that the germs of these organisms do not exist in the air, nor multiply by self division, nor are they capable of elongating or aggregating, thus forming filaments or larger masses, unless by the union of other molecules like themselves. Having shown, from the observations of Pasteur and others, that the germs cannot preëxist in the air, he holds that they cannot preëxist in the water, as the numerous experiments by Pouchet, Meunier, etc., have shown that all animal and vegetable germs are killed by boiling them; yet nothing is more certain than that long ebullition of various infusions has wholly failed to prevent the formation in them of animal and vegetable growths," the molecules appearing in them after the water cools. He ascribes their origin to phenomena of a chemical nature, the results of the discussions in the French Academy of Sciences for the last eight years, showing "that not the slightest proof is given by the chemists, with M. Pasteur at their head, that fermentation and putrefaction are necessarily dependent on living germs existing in the atmosphere. They rather tend to show that these are phenomena of a chemical nature, as was ably maintained by Liebig. In conclusion, the author holds that the infusoria, animal and vegetable, "originate in oleo-albuminous molecules, which are formed in organic fluids, and which, floating to the surface, form the pellicle or proligerous matter. There, under the influence of varied conditions, such as temperature, light, chemical exchanges, density, pressure, and composition of atmospheric air, and of the fluid, etc., the molecules by their coalescence, produce the lower forms of vegetable and animal life."

Chicago Microscopic Club.—We have received the Constitution and By-laws of this new society, and the Proceedings of the meeting held January 26th, when Prof. Freer exhibited human blood cells showing the cell as a bi-concave disc, with a nucleus appearing as a prominence in the centre; most microscopists having denied the existence of a nucleus in the human blood disc.

ANSWERS TO CORRESPONDENTS.

A. J. O., Morristown.—We would be much obliged for specimens of sheep ticks and their eggs and young, with notes on their habits.

J. S., Lancaster, Pa.—Your notes and sketches of bird parasites were of great interest to us. We would be greatly indebted to ornithologists for specimens of bird ticks, lice, mites and other external parasites, with their eggs and young, as well as parasitic worms, such as the tape-worms and the "round worms." They may be collected in vials of whiskey or weak alcohol, and sent by mail in a strong pasteboard box, or roll of tin. Has any one ever found the bed-bug in swallow's nests; they occur thus in Europe.

S. W. C., Otisco, N. Y.—After making your insect case as nearly air-tight as possible, place camphor in a paper with pin holes, or smear the box with creosote, or keep benzine in constant evaporation in the box. Beetles may be soaked in a solution of corrosive sublimate previous to arranging them in the insect-case. Above all, watch carefully for dust made by devouring insects, which falls to the bottom of the case containing them, by which we may detect their presence in the case.

The Date Palm.—In answer to a correspondent who enquires whether dates ever grew so low that a man can pick and eat them as he walks under the tree, we answer

that dates are ripened even when the tree is so young that the clusters may easily be reached from the ground, but the sharp bristling leaves would most effectually prevent any one from walking *under* the tree. In Egypt the heavy clusters hang down from the base of the leaves, and even in mature trees may be picked by a man on horseback. The fruit ripens separately on the cluster, and the process goes on for some weeks. The date-palm is by no means a shade tree, and not a pleasant tree to walk under, as the dead and persistent leaves hang and project at various angles, and even where these are trimmed away, the stem remains rough and spiny.—WM. T. BRIGHAM.

J. S., New Albany, Ind.—Your specimen is a portion of a growth of some sort of suberose, or corky fungus, such as grows out of the dead or living, but old and hard bark of living trees. It consists, as you will find on macerating a bit of it, of a compact mass of fibres or threads once alive, and which is called 'mycelium;' and this particular kind can be found frequently between the layers of the timber of the solid trunk, and by its presence the wood is finally destroyed. It is known to botanists as *Racodium Xylostroma* of Persoon, the first word signifying "like a rag," the second "woody-bed," or bed in the wood. It has another name given it by Tode, *Xylostroma giganteum*, or the "great woody bed," and may be found in the timber of the oak, beech, etc., both in this country and in Europe. There are also other species of *Racodium*, some of which from resemblance, are called "Mouseskin," and the like names. —J. L. R.

CORRECTIONS.—Mr. Dall desires us to correct his statement in the March NATURALIST that "no snake of the genus *Elaps* is poisonous," as some of the species are poisonous.

Prof. S. D. Cope writes us that the dislocation in the jaw of the ally of mosasaurus (mentioned on page 55) is normal, and not the result of an accident,—our own inferences were incorrect.—EDS.

BOOKS RECEIVED.

Practical Floriculture; A Guide to the Successive Cultivation of Florist's Plants, for the Amateur and Professional Florist. By P. Henderson. Illustrated. New York: Orange Judd & Co. Price $1.50.

Library of Education. Some thoughts concerning Education. By John Locke. New York: J. W. Schermerhorn & Co. 1869. 32mo, pp. 192. 15 cents.

The Pampas and Andes. A Thousand Miles' Walk across South America. By N. A. Bishop. Boston: Lea & Shepard. 1869. 12mo, pp. 310.

The Record of Zoölogical Literature, 1867. Vol. IV. Edited by A. C. L. Günther. London, 1868. John Van Voorst. 8vo, pp. 678.

Scientific Opinion (Weekly) for January, 1869. London.

Journal for the Popular Diffusion of Natural Science. Edited by C. Fogh, C. F. Lütken, and Eug. Warming. Series iii. Vol. I, Part 1. Copenhagen, 1869. 8vo.

Archiv für Anthropologie. Vol. II, Part 3. Braunschweig, 1868. 4to.

Cosmos (Weekly). December 19—February 6, 1869. Paris. 8vo.

Canadian Naturalist and Geologist. Second series. Vol. III, Nos. 1-4.

The Field. December 19—February 20. London.

Journal of Travel and Natural History. Vol. I, No. 4. London. 8vo.

Land and Water. November 28—February 6.

Popular Science Review. January, 1869. London.

Quarterly Journal of Science. January, 1869. London.

American Bee Journal. February, March, 1869. Washington, D. C. $2.00 a year.

Bulletin of the National Association of Wool Manufacturers. Jan., 1869. Boston. 8vo.

Le Naturaliste Canadien, Bulletin des Recherches, Observations et Decouvertes se rapportant a l'Histoire Naturelle du Canada. Tom. I, No. 2. Janvier 3, February, 1869. 8vo, pp. 25. $2.00 a year.

Report of the Commissioners of Fisheries for the year ending January 1, 1869. Boston, 1869. 8vo, pp. 71.

The Canadian Entomologist. February 15. Vol. I, No. 7. Toronto.

The American Entomologist. March, 1869. St. Louis: R. P. Studley & Co. $1.00 a year.

One Thousand Objects for the Microscope. By M. C. Cooke. With five hundred figures. London, 1869. 12mo. Price $1.00.

THE

AMERICAN NATURALIST.

Vol. III.—MAY, 1869.—No. 3.

A NEW SPECIES OF HARE FROM THE SUMMIT OF WIND RIVER MOUNTAINS.

BY PROF. F. V. HAYDEN.

IN the summer of 1860, the U. S. Exploring Expedition under the command of Capt. William F. Raynolds, U.S.A.,

crossed over the Wind River Mountains into the valley of the Columbia River. The writer was connected with that expedition as Geologist and Naturalist. May 30th, we camped at the foot of the eastern slope of the mountains, at the source of Wind River. It was a beautiful locality, and at this time the spring had fully come. Myriads of flowers covered the valley, and the trees and shrubs were clothed with foliage of the peculiar bright green color characteristic of this mountain scenery. On the north side of this valley were the rugged basaltic ridges of the western end of the Big Horn Range, where it united itself with the Wind River Range, and on our left were the forest-covered, gently descending slopes of the Wind River Range. Fine springs issued from the sides of the mountains everywhere, and all the little branches were full of trout.

On the morning of May 31st, we ascended the eastern slope, and gradually the vegetation dwindled down in size, so that it presented an Alpine character, and before reaching the summit, we were pushing our way through ten or fifteen feet of snow. Upon the summits of these mountains quite large areas are covered with perpetual snow, portions of which melt away in midsummer. Every few moments the clouds dropped down rain or snow, and then the sun shone out as bright as ever. We were obliged to spend several days on the summit of these mountains. So far as I could ascertain the fauna on the west side of the Wind River Mountains is quite distinct from that on the eastern side. One day I noticed a group of singular tracks on the snow which seemed different from any I had ever observed in the West, and they appeared to belong to an enormous species of hare. Descending the western slope about a third of the way from the summit, we saw a number of these animals in the little patches of pine forests, and succeeded in capturing several of them, old and young. I saw at once that it was a species not previously observed by me, and most probably undescribed. The following is a brief description of this hare:

Lepus Bairdii Hayden, Baird's hare.—Summer dress: General color gray, glossed behind, especially on the rump, with sooty black; feet and tail, and the edges of the ears white, the latter not darker at tip. Nape sooty. In winter pure white. Length to base of tail about sixteen inches (tail mutilated). Ear three inches high; hind feet six inches long.

This interesting new species of Alpine hare, as far as our observations extend, is confined to the Wind River Mountains, where it is by no means rare, and forms a characteristic feature of the landscape, its unusually broad feet expanding with each step, forming a set of veritable snow-shoes, enabling it to pass rapidly over the surface of the snow without sinking. It is readily distinguished from Townsend's Hare, or the Missouri Jackass Rabbit by its smaller size, much shorter ears, and different colors. It is considerably larger than *L. sylvaticus* and *artemisia*, with disproportionately large feet and sooty nape, being neither chestnut nor reddish. In some respects it resembles *Lepus campestris* of the Hudson Bay country, which, however, is more like *L. sylvaticus*, although much grayer, and like *L. Bairdii*, with a sooty nape. It is, perhaps, with the true Polar Hare (*Lepus glacialis*) that it is to be compared the most properly. Its summer dress is much the same, but it is much smaller, and lacks the black tips of the ears. The hind feet are, however, of nearly the same size.

This hare seems to be restricted to a comparatively small area on the summits of these mountains, near Fremont's Peak, about longitude 110°, and latitude 43°, so far as our present knowledge extends; and its natural habitat appears to be among the perpetual snows, from which it descends at pleasure to the little open spots on the slope for its food. If it were widely distributed it could not so long have eluded the observations of so many travellers who have crossed these mountains before and since 1860. But at this immediate locality it appeared to be abundant. It subsists on grass, but is very fond of the bark, buds and leaves of small

shrubs, especially the pine buds. Its meat is very white and tender, affording the most delicate food for the traveller. For tenderness and fineness of fibre, the meat of this hare not only differs from, but surpasses all others of the West. It holds a similar position among the hares that the Dusky Grouse does among the Western Grouse; both have white and very delicate meat, and prefer to obtain their food from the pine shrubs.

Descending the western slope of the mountains into the valley of the Snake Fork, we were again surrounded with all the indications of spring. The trees were clothed with fresh green foliage, and myriads of flowers were in bloom, and all signs of winter had passed away. In the course of a single day one may ascend to the region of perpetual snow, and descend again to that of spring and summer.

THE SAND MARTIN.

BY AUGUSTUS FOWLER.

THE Sand Martins (*Hirundo riparia*) visit their accustomed breeding-places in Essex, County, Massachusetts, usually the first week in May, in companies sometimes to the number of fifty pairs. They select the bank of some river, or the sides of any large excavation, in which they dig a hole from one to three feet below the surface of the ground in a straight, horizontal direction. The holes are usually from two to three feet in length, and often within a few inches of each other; the entrance and passage-way to the nest being of an elliptic form. They prefer the most perpendicular banks, with a stratum of sandy loam below the soil. They live together in the most social manner, and unlike the White-bellied Swallow (*Hirundo bicolor*) are seldom seen to quarrel with each other. If at any time one of them should, in digging his hole, intrude upon the passage

of another already excavated, he leaves it and begins a new one in some other place. After having completed their burrow they deposit at its farther extremity a small quantity of soft dried grass, so adjusted that the largest part of the material is placed towards the passage-way, and then line it with a few large *white* downy feathers. I say white feathers, because I have always observed they prefer the whitest they can get for the purpose; it shows a proper taste in the birds, a fit symbol of their innocence, and I should be surprised to find a swallow's nest of this species lined with black or even dark-colored feathers. In the nest thus formed the female deposits from four to six eggs, which are pure white, with a very thin transparent shell; they are six-eighths of an inch in length, and one-half of an inch in breadth. Nature has not bestowed on this bird that graceful motion when on the wing that the Barn Swallow exhibits, but she has given it the most amiable disposition of all our swallows.

I have noticed an instance of the sense and reflection of these birds, for if reason did not influence them in their operations, it seems as if there never was evidence of its existence in animals. There is in the town of Beverly a bank, formed by the removal of clay for the purpose of making bricks, which is every season occupied by twenty or thirty pairs of these birds. Above the clay there is a stratum of sandy loam, from two to three feet in depth; in this they burrow from two to three feet. There is likewise in the town of Danvers a bank which swallows occupy, in which the layer of loam is mixed with gravel or small stones. They excavate this bank to the length of five, seven and even nine feet. For two or three seasons it was undermined.

Why should there be such a difference in the length of the burrows made by the same species of birds, in situations not more than a mile distant from each other? In one bank, after examining a number of their holes where the earth was of a fine sandy loam, easily perforated, it was noticed that

from the entrance to the extremity, the burrows did not exceed three feet in length, while in the other bank, with harder loam to work in, one burrow was found which was nine feet in length; and after examining six different holes, of nearly the same length, it appeared that these little birds had sufficient reason for extending their labors so far in the earth; in every instance where they met with a spot of loam, free from stones, they finished their burrows; if they met a stony soil they showed great care for the welfare of their eggs or young in avoiding a catastrophe so great as would befall their treasures if by accident a stone should fall upon them; for this reason they excavate to the great depth above referred to. As with man so it seems with them; reason appears to teach them what effects certain causes will produce; hence the care they exhibit in depositing their eggs in a place free from danger of harm.

After they arrive at their breeding-places, they seem to spend a few days in consultation with regard to the organization of their little colony; at such times numbers of them will be seen clinging to the bank, keeping up a low twittering, while others may be seen circling and wheeling around with much apparent joy, passing each other with that gracefulness and ease that are characteristic of no other birds except those belonging to the swallow family, not however without a friendly greeting in a low chatter, with a little variance of cadence. No party of beavers are more regular, or swarm of bees more formal, than are the colonies of these birds.

In watching their operations, while some were perforating the bank and others leaving it, in search for or returning with materials to construct their nests, it is noticeable that at a given signal, a short time before sunset, they quit their labors simultaneously, and in a few moments not an individual is seen near the bank, but over some pond, or field, or high in the air hunting their food. And when the colony returned it was in the same manner, all in company; they

would then hover awhile about the bank, and one after another dive into their burrows and disappear for the night.

Another interesting period in the life of this bird is when their young begin to fly. No mother looks upon the first steps of her child with more interest and pleasure than do these birds seemingly upon the first flight of their offspring. For a few days the young appear at the entrance of their burrow, watching the old birds in their flight as they pass and repass, and stopping now and then to leave them food, and are at last induced to leave the bank and try their wings, when they are followed by their parents until they are safely perched upon some object, to receive in a chattering way, their praise and congratulation for the success in their first attempt in flying. The young are fed for a few days upon the wing, and when abandoned to seek their own food may be seen in pairs or small parties, two or three miles from the place of their nativity, skimming over the fields and pastures. Their food consists entirely of insects.

Among the festal days observed by the Greeks, there was one called "the Welcome of the Swallows," when the children would march through the streets with garlands of roses and with music to receive presents, and as this swallow is one of those interesting "guests of summer" which always visits us, and as there is not even a suspicion that he is harmful to man, let us welcome him.

THE WHITE-FOOTED OR DEER MOUSE.

BY J. D. CATON.

THIS species of the *Mus* family has been noted for two characteristics, not confined to it alone but still rare. One is that it is an active tree-climber, and very frequently makes its nest upon or in trees, sometimes at a considerable distance from the ground; and the other is its mode of transporting

its young, which, as usually observed, is by the latter adhering to the teat of the mother, who drags them along in her flight from danger.

In October last I observed a bunch of sticks and twigs in a thorn bush, about thirty inches from the ground, about the size of one's head and rounded on top, with no appearance of ever having been occupied by a bird. When the axe-man struck the root of the tree, a White-footed Mouse (*Mus leucopus*) rushed from the nest with two of her young family, fully half-grown, attached to her. She coursed up and down the limbs, and from one limb to another, dragging her heavy load after her. Occasionally both would drop down on either side of the limb along which she was dragging them. Sometimes when she would reach a lateral branch, the young hanging its whole length below it, she would *yank* the infant with a force truly surprising, which must have been a severe test upon the hold of the little one.

Two observations interested me particularly: First, the young were not adhering to the teat, which has been supposed to be the universal habit of this mouse, but were adhering *to the outside of the thighs*. In this observation I do not think I could have been mistaken, as I was struck with this peculiarity, and stood within a yard of them, and she stopped in plain view several times in apparent doubt as to which way to go, and once on a limb about an inch in diameter, and with one of the young hanging down on either side, which gave me the best possible chance for an accurate observation. The young, though large enough to have fled much faster than the mother could drag them, made no effort to assist in the flight, but contented themselves with passively hanging on. Second, the young were of a dull blue or lead color, *darker* than the common house-mouse, and *showing no white* on the feet, belly or sides, which is always observable in the adult.

My desire to secure them as specimens was overcome by my sympathy for the afflicted mother, and I allowed them to

escape. This was done after having once retreated to the nest, and left it again upon a new alarm, when she run out upon a limb as far as she could, and jumped to the ground, a distance of full four feet, the young still adhering to her.

I did not, as I should have done, examine the internal arrangement of the nest. If she had taken possession of an abandoned bird's nest, she had completed the structure by adding to it till the top presented a full convex form.

THE FLORA OF PALESTINE AND SYRIA.

BY REV. GEORGE E. POST.

Palestine and Syria embrace four distinct botanical regions:

I. The sea-coast plain and lower slopes of the hills, with the deeper valleys, which run far into the heart of Lebanon and the hill country of Galilee. The climate of this region is subtropical, and fosters the development of the banana, the palm, the sugar-cane and the orange. In this region frost is almost unknown, snow is quite rare, being seen only once in ten or fifteen years, and the hot sun of summer pouring on a soil made humid by irrigations, develops a luxuriant vegetable life.

II. The mountain sides, from 1000 to 4000 feet above the sea, with the valley of Cœle Syria, and the plain of the Orontes. Here the flora changes. The palm will no longer flourish. The banana refuses to fruit. The orange and the lemon cease to be productive, and their place is taken by the oak and the willow, and the pine and the maple. The olive and the mulberry are equally productive in this and the foregoing region, but in this form almost the only orchards, while on the plain they share the attention of the farmer with the before mentioned trees. In this region wheat and

barley flourish, and the vine attains the most perfect development. The herbaceous flora of these two regions is similar in type, except that as we rise on the mountain sides the Tetragontheca and Stachys, and Squill and Pancratium of the plains begin to yield to the thorny mountain species of Astragalus, and Tragacanth, and Eupigium, and the aromatic Origanums and Teucriums.

III. A third region comprises a small part of Cœle Syria, near the head waters of the Litany and Orontes, with the plain east of Damascus and Hums. The soil of this region is thin, being fit only for the production of grasses and thorny herbs, the scanty pasture of the Arab's flocks and herds. Here grow *Centaurea dumulosa*, and *Delphinium anthoroides*, and many Astragali and other Leguminosæ, while not a solitary tree, or even shrub, enlivens the dreary landscape. It is the type of those great waterless plains, which, for a short space, interrupted by the fertile district of Mesopotamia, extend eastward through Persia to the great desert of Cobi.

IV. The fourth of these regions is from the height of 4000 feet on Lebanon and Hermon, to their snow clad summits. Here the scanty remains of their once extensive forests of cedar and oak, and pine, end at an elevation of 6000 feet above the sea, and for the remaining 4000 feet of naked rock, we have left such treelets as the Cotoneaster, and *Prunus prostratas*, and *Daphne olæoides*, while the herbaceous flora is represented in the lower regions by *Astragalus lanatus*, *Alyssum montanum*, and *Ranunculus demissus* and *Viola ebracteolata*, and higher up by hemispherical bogs of a species of *Astragalus*, *Onobrychys tragacanthus* and *Acantholimon Libanoticum*, while on the extreme summit of Lebanon we find *Ucia canescens*, and of Hermon, *Pyrethrum densum*.

A fifth region might be enumerated, viz., the plain about Jericho, in which, owing to the depth of its surface below the sea, about 1300 feet, and the reflected glare of the sun from the mountains and surface of the Dead Sea, the heat

mounts to equatorial degrees, and a flora is found resembling that of Lower India. More than twenty species are found here and around Engedi, which are not found again until we cross the Himalayas.

Thus it will be seen, that while on the summit of Lebanon there is a plant, *Oxygia reniformis*, belonging to the Arctic flora, in the valley of the Dead Sea we have representatives of the vegetation of the torrid zone, and this in the midst of a region with a temperate climate, by a special arrangement, seemingly designed to extend the range of human thought and observation within limits almost microcosmical. For while on any high mountain in the tropics we may have the near conjunction of these diverse forms of vegetable life thus answering the ends of variety and comparison, yet the general surface of the country in such cases would be torrid, and hence ill-adapted to the development of a hardy independent race, such as inhabited the mountains of Palestine and Syria. In the Holy Land, however, the end is gained by sinking a small section down to a tropical level, leaving the rest of the country more favorably situated for the support of vigorous life, and the development of individuality of national character.

A single observation more is in place here. It is that in Syria all plants necessary to life, or conducive to health, are either indigenous or flourish under cultivation in the open air, and that the indigenous materia medica supplies types of all the leading groups of remedies used in the healing art. This statement is illustrated by the fact that in the gardens of Syria grow the potato, bean in all its varieties, Indian corn, egg-plant, squash, pumpkin, artichoke, cucumber, onion, tomato, turnip, cabbage, cauliflower, spinach, carrot, beet, and many other vegetables, and the lemon, orange, citron, pomegranate, apricot, plum (in all varieties), peach, apple, cherry, blackberry, mulberry, banana, fig, date, grape, and other kinds of fruit; the walnut, pistachio, filbert, almond and other nuts; the squill, castor oil plant, elaterium, scam-

mony, colocynth, salep, acacia, galls, poppy, *Conium maculatum*, aloe, various Euphorbias, madder and many other medicinal and economical plants.

THE FAUNA OF MONTANA TERRITORY.

BY J. G. COOPER, M. D.

(Concluded from page 84.)

III. REPTILES.

Horned Toad (*Tapaya Douglassii* Gir.). A single specimen was obtained at Fort Benton. Though found on the Columbia Plains this species does not seem to cross the mountains at this point, but probably does so by the head of Snake River.

Rattlesnake (*Crotalus confluentus* Say, possibly also *C. Lucifer* B. and G.). I saw but two rattlesnakes in the Rocky Mountains, which were on a prairie along Hell Gate River. Expecting to find more I did not preserve them, but as specimens were probably obtained by Lieut. Mullan, I mention the localities of this and other reptiles which I did not preserve. All kinds were very scarce in the mountains, and this, which is so abundant along the Platte, is rather rare near Fort Benton. I mention this as the species seen on the west slope, because the Bitterroot Mountains are a far greater obstacle to the migration of the *C. Lucifer* eastward, than the main divide is to that of this, and I killed some of *C. confluentus*, probably, as high as 5000 feet above the sea on the east slope.

Pine Snake (*Pituophis*). I also got a Pine Snake at Fort Benton.

Green Racer (*Boscanion vetustus* B. and G., or *B. flaviventris?*). I saw one dead specimen of this snake along Hell Gate River in August.

Wandering Gartersnake (*Eutainia vagrans* B. and G.). Rather common along Hell Gate and Bitterroot River.

TOAD (*Bufo Columbiensis* B. and G.?). A large toad was occasionally observed along the Hell Gate and Bitterroot Valleys, but was not very common.

SPOTTED FROG (*Rana halecina* Kalm). I saw this frog on the Missouri among the mountains, which it probably crosses, being found at Fort Dalles by Dr. Suckley.

IV. FISHES.

LEWIS' TROUT (*Salmo Lewisii* Girard). This fine trout abounds in the headwaters of the Missouri, up to their sources on the eastern slope of the mountains, and a few were taken at and near Fort Benton by the soldiers, all of them large ones. They bite readily at almost any artificial fly; also at insects, meat, pork, and even leaves and flowers, after they had been tempted with grasshoppers. Officers and men, nearly all who were not on duty, would crowd to the banks of the beautiful mountain streams, and catch as many as the whole command of three hundred men could eat every day, and with tackle of all kinds, from a rude stick with a piece of common twine and a large hook, to the most refined outfit of the genuine trout-fisher. The form differs very much from the figure given in Dr. Girard's Report, and in the Natural History of Washington Territory, being, as the specimens show, much more elongated, like most other species. I also took specimens of small size across, to compare with those on the western slope, and am very doubtful whether these can be considered a distinct species, though a comparison of larger specimens may prove them to be so. If distinct, the trout of the western slope is exceedingly near *S. Lewisii*. It is equally abundant down to the crossing of the Bitterroot, but less so in the streams on both sides of the Cœur d'Alene Range, probably from their excessively shallow and rapid current. I saw no difference, however, in those taken at Cœur d'Alene Mission from those of the Little Blackfoot. The differences noticed between these and those of the Missouri were as follows:—Evidently fatter and in better

condition, from which, I suppose, arose the deeper tint and greater extent of the rosy tint on their side and belly; back paler olive; spots fewer and chiefly near the tail, where they assumed a more stellate arrangement, but this was not constant. Very young specimens, four to five inches long, were barred on the sides. I saw none so small on the east slope.

No. 61, Little Blackfoot River, August 17th. No. 69, near crossing of Bitterroot River, September 2nd. Length, 14.75 inch; olive, below silvery with rosy tints towards sides; spots black; operculum, etc., bronze gilt; chin-mark orange.

Salmo sp.—A single specimen of a species of trout was caught by Lieut. A. V. Kautz, U. S. A., on September 25th, just below the ferry across the Spokan River, at Antoine Plant's. Its very dark hue corresponds to the color of the stream, which is often the case in fish of the same species found in different localities, but it otherwise differs very much from the preceding. There is a high fall of the river *below* this point not passed by the salmon, so that this species cannot be a hybrid with them or anadromous either. No. 121, dried skin; colors when fresh were very dark olive above; belly dull white (no rosy marks); chin-mark reddish purple; operculum coppery, with a deep purple tint, this continuing as a broad streak along lateral line. Form of head very obtuse.*

SUCKLEY'S SALMONTROUT (*S. Suckleyi* Cooper, nov. sp.).

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*Besides *Salmo Lewisii*, the following fish were caught at and near Fort Benton, most of which, probably, do not go above the falls:

PIKE PERCH (*Stizostedion boreus* Gir.). Not very common.

CATFISH. *Pimelodus olivaceus* Gir. was the only catfish seen above Fort Union, below which *P. ailurus* Gir. is common. It is excellent eating, preferred by many to trout, which cannot be said of other catfish.

MILK RIVER SUCKER (*Acomus lactarius* Gir.). Common and very poor eating.

MISSOURI SUCKER. (*Catostomus Suckleyi* Gir.). Not very common.

NEBRASKA DACE. (*Pogonicthys communis* Gir.). Abundant below Fort Benton, but scarce so far up.

MISSOURI HERRING (*Hyodon tergisus* Lesu.). Common, and bites sharply like a trout, giving good sport, but is poor food.

SHOVEL-NOSED STURGEON (*Scaphirhynchus platirhynchus* Baird). Several were caught near Fort Benton.

PIKE (*Esox sp.*). This large pike was cut up before I saw it, and I only got the head, which I gave to Mr. Hildreth to send to Washington.

I obtained also in the Rocky Mountains a species of Whitefish (*Coregonus?*), a Cottoid (?), and four species of *Cyprinoids*, which are probably still undescribed, but the specimens were too much damaged in alcohol to determine them with certainty.

Salmontrout of the Kalispelm or Lake Pend d'Oreille; Suckley, Report on Natural History of Washington Territory, under *S. Gibbsii* (?).* The first of this splendid salmontrout we met with were at the mouth of St. Regis Borgia creek, which flows down the east slope of the Cœur d'Aleñe Range, and joins the Bitterroot, where the road crosses and leaves that river. The large specimen was brought to camp by Indians. An old mountaineer who keeps the ferry, said that they could be caught with a hook baited with a small fish, but these two had evidently been speared. We saw several of them in this stream, but all refused to bite at a fly or any common bait. Those caught in the Cœur d'Aleñe, on the west slope, seemed to be identical, and I preserved a small one (No. 110, in alcohol). No. 95 was evidently about spawning, the ova being as large as peas, like those of the large salmon. Its colors were pale olive above, with irregular greenish patches; sides yellowish, beneath silvery white; fins and tail tinged with red; spots on back carmine, large and few; tail a little emarginate; length 29½ inches. The other was slightly smaller, otherwise like this. No. 110, young, was darker above, and colors brighter.

DOG SALMON (*Salmo canis* Suckley). Below the forks of the Spokan, the Indians were catching myriads of this salmon, and curing even those washed ashore, in their exhausted, diseased condition, without scales, and presenting all the appearances described in our report of 1853, relating to the salmon of the Upper Columbia.

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* This query in Dr. Cooper's manuscript we suppose means that he did not have the book at hand, and was not sure that the specimen he refers to was mentioned by Dr. Suckley under *S. Gibbsii*. As we cannot find a reference to the locality given under S. Gibbsii, we think that Dr. Cooper intended to refer to the following paragraph by Dr. Suckley under *Salmo spectabilis* Gir. (Nat. Hist. of Washington Territory and Oregon, page 343). "In Lake Pend d'Oreille, a sheet of water formed in the second chain of the Rocky Mountains by a dilatation of the Clark River, of much the same size, shape, and general character as Lake Geneva in Switzerland, I have seen a very handsome species of red-spotted lake trout. The spots along the flanks are of the size of large peas, and are of a beautiful rose color. The length of the adult fish will average twenty inches. Its form is slender, and the dorsal profile but slightly arched." Much valuable and interesting information relating to the Salmonidæ of the northwestern part of America is contained in Dr. Suckley's chapter on this family in the Natural History of Washington Territory, etc.—EDITORS.

THE FLOWERS OF EARLY SPRING.

BY REV. J. W. CHICKERING, JR.

THERE is perhaps a nearly equal charm about the notes of the first robin, and the sight of the first Mayflower. It will be the object of this article to enumerate, with a few notes upon each, some of our earlier floral visitors, in wood and meadow, in New England.

The list opens, not very attractively, with a plant well known to all, under the mal-odorous name of Skunk Cabbage (*Symplocarpus fœtidus*), but whose flower is by no means so familiar, save to the observing botanist, and even he must be on the alert to obtain this first gift of Flora, in full perfection of color and aroma. Early in April, or even in March, almost before the ice is fairly melted, may be found in low marshy ground, this flower, clumsy in form, repulsive and snaky in color, dark purple with yellowish blotches, and disgusting in odor; soon to be followed by the clump of large fleshy leaves, conspicuous during the rest of the summer. Like Stramonium, and most other noxious and unsightly weeds, it has been tried as a remedy for asthma, and with about as much effect.

In very pleasing contrast comes next *Epigæa repens*, or as it is sometimes miscalled Trailing Arbutus, better and more appropriately known throughout New England as the Mayflower.

This, among the very earliest, is also the choicest gift that Flora has in this latitude to offer us, alike for its beauty of form and color, its delicious fragrance, and its charming habit of peeping out, almost from the edge of the retreating snowdrifts. To find the first bunch of Mayflowers is the ambition of many a boy and girl, as well as not a few children of larger growth. The finest specimens ever seen by the writer were from a mountain in Camden, Maine. It has

also been used as a medicinal agent, but with no better nor worse results than many others. It is a true wild flower, resisting all attempts at domestication. Closely associated with this is found the *Hepatica*, in its two forms of *triloba* and *acutiloba*, one with rounded, the other with pointed leaves, probably merely varieties. The little clump of flowers pushes its way through the ground, often in advance of the leaves, and with the varying shades of pink, blue and white, seen in different plants, is a welcome addition to our spring bouquet, though lacking the fragrance of the Mayflower.

About this same time the southern aspect of rocky hill-sides begins to whiten, with the cheerful, though not specially graceful or showy flowers of the Early Saxifrage (*Saxifraga Virginiensis*), and in forest marshes the inconspicuous little Golden Saxifrage, with a name longer than itself (*Chrysosplenium Americanum*). Soon in the meadows the carpet of living green is embroidered with the golden flowers of *Caltha palustris* or the English Marsh Marigold, improperly called Cowslip, and whether correctly or not, associated with creamy milk and yellow butter, while a little later are seen in the morning sun, the white stars of the Bloodroot (*Sanguinaria Canadensis*), as fragile as they are beautiful, generally lasting but for a day. Its orange-colored juice is much used in medicine as an emetic, an expectorant, and a liniment. This plant readily bears transplanting, increases in size under cultivation, and becomes one of the most attractive ornaments of the early flower border. In some parts of the country is found a somewhat similar flower, the Twin-leaf, or Rheumatism Root (*Jeffersonia diphylla*), also well repaying cultivation.

Meanwhile the pastures are beginning to whiten (last year remarkably) with the modest little Houstonia, or Innocence (*Oldenlandia cœrulea*), while a host of violets are making their appearance. *Viola blanda*, a wee, white, sweet-scented species, in the woods; *cucullata*, with its large blue flowers

and hood-shaped leaves, with their curious palmate variety; *rotundifolia*, with yellow flowers and shiny leaves; and on the hillsides and in the pastures the widely varying *sagittata*. *Claytonia Virginica*, well named Spring Beauty, must not be neglected in its moist and generally shady bed.

Along streams in open woodlands, we may find the Spring Cress (*Cardamine rhomboidea*), with large, white flowers; and just shooting up its green stalk, its first cousin the Winter Cress (*Barbarea vulgaris*).

Nor should the floral efforts of trees and shrubs be disregarded. Among the earliest indications of spring the Hazel-nut (*Corylus rostrata*) shakes its long catkins along the roadsides, before any signs of swelling leaf-buds are visible, while the Willows (*Salix*), whose name is legion, begin to burst their warm wintry covering. The Savin (*Juniperus Virginiana*) is covered with its curious little flowers. The Hemlock (*Abies Canadensis*) is early in flower, as also the American Yew (*Taxus baccata*). All these require close examination to detect their inflorescence, but well repay it. The two maples, *Acer dasycarpum* (the Silver Maple) and *Acer rubrum* (the Red Maple), hang out their showy pendants very early. The Sweet Gale (*Myrica Gale*), along the edges of swamps, and the Sweet Fern (*Comptonia asplenifolia*), whose dried leaves are the basis of juvenile attempts at smoking, are now in flower; and *Dirca palustris*, well named Leather-wood from the marvellous toughness of its bark, such that it is frequently used in default of leather or twine in repairing broken harnesses or sleds, hangs out its little yellow bells in advance of any leaves.

We close the list with the fragrant Sassafras (*S. officinale*), well known by its aromatic bark and curiously lobed leaves, not so well by its early clusters of yellow flowers, somewhat resembling those of the Sugar-maple; and the Spice-wood, or Fever-bush (*Benzoïn odoriferum*), also highly aromatic, and possessing, like the Sassafras, medicinal value as an aromatic stimulant. Such are the earliest flowers,

which in forest, field or fen, invite the search of the botanist and the lover of nature.

Perhaps subsequent articles may give some notes upon the flowers of later spring, summer and autumn, with a floral calendar, and possibly an enumeration of some plants and shrubs well worthy of a place in garden or shrubbery, but hitherto neglected. If this shall succeed in leading any to a closer study of nature's beauty, and the goodness and glory of the Creator, its object will be answered.

THE FRESH-WATER AQUARIUM.

BY C. B. BRIGHAM.

THE art of preserving water animals alive and in good condition, as pets or as objects of study, is not of recent date; but the principles of what is now commonly known as the aquarium, were not until lately brought into general notice. The Romans had their tanks of game fish, the English and French gardeners their vessels for the growth of tender water-lilies or other valuable aquatic plants, yet the happy thought of uniting the two,—fishes and plants,—so that the one should balance the other, each aiding in the others support, making withal a collection of such proportions as to be conveniently kept indoors, is the production of comparatively late years.

Dr. Johnstone, of Liverpool, has the reputation of having been the first to apply practically the principles of the aquarium; he made experiments with the *Corallina officinalis*, Starfish, *Confervæ*, and some small plants of the *Ulva latissima*, and found that they flourished for eight weeks without being disturbed; this led him to try some fresh-water fishes and larvæ, and they succeeded even better than the salt-water specimens. Since then Gosse, Hibberd, Warington

and others of England, and the late Mr. Cotting, of Boston, have done much towards forwarding the interests of the aquarium. The whole secret of the success of the aquarium lies in the exactness with which we imitate nature in arranging and disposing our collections; but let us understand first of all that what is meant by the term an aquarium is a collection of water plants and animals, so arranged in suitable ratio that it shall be perfectly self-supporting. We do not expect, then, that the water will have to be changed until after long periods, if at all; the plants and animals should flourish as well as if in their native locality.

How then is this balance of forces to be attained? This leads us to examine the philosophy of the aquarium, which is simply this: The element in water which the fishes live on by breathing is free oxygen, which, as the water is fanned through the gills or lungs of the fish, comes in contact with the walls of its vessels, and arterializes the blood; all water contains a certain amount of this oxygen, sufficient to keep a fish alive for a short time, but if no means are taken to create a fresh supply, it will become exhausted sooner or later, and an escape of carbonic acid will render the water poisonous to the fish. In plants on the other hand we have an agent taking up the carbonic acid in the water, and resolving it into carbon and oxygen, the former of which it converts into its substance, while it expels the latter from every part of its tissue, especially from the leaves in the form of minute bubbles, plainly seen in healthy plants, and so often compared to drops of quicksilver in appearance. It is true that plants absorb oxygen also as fishes do, but they give out so much more than they absorb, that this is of slight account.

Another oxygen producing agent, as was shown by Liebig, is to be found in the almost microscopic forms of animal life which abound in water which has stood for some time exposed to the air. These animalculæ seem to form another link in the chain which binds together all kinds of animal

life of higher or lower order, however apparently diverse they may be. This extra supply of oxygen adds greatly to the support of the aquarium, and is no doubt the reason why a large number of fishes can be supported with a seemingly small proportion of plants. It would indeed be an interesting experiment to try, were we to place a small fish in a large tank, and see if, from the oxygen of these infusorial animalculæ alone, life could be sustained.

It must be the aim of him who wishes to establish an aquarium to see that this balance of plants and fishes is effected, for it is indispensable. Starting then with some idea of what we wish to accomplish, the first inquiry is about the kind of tank we are to use. This is an affair of more than mere fancy, convenience, or economy, for it is important for the growth of many plants that they should have the greatest amount of light possible, and this is especially true with fresh-water plants; so that where a washbowl or a tub would make an excellent tank for a salt-water collection, the same might fail of success in one with fresh-water. Besides there are many specimens which we wish to examine sideways, and obtain that view which it is not possible to have in nature, namely, that of a vertical section of a pond. The requirements of a good vessel or tank for an aquarial collection, are strength and sufficient transparency; these we have in a moderate degree in the inverted bell-glasses, or cake covers, of confectioners. If, however, the glass becomes cracked and broken from any cause, and it is surprising how easily it is broken, the whole collection of specimens is in great danger of being lost, especially if the accident happen in the night-time. Another disadvantage which the cake covers have is, that through them the specimens are sometimes magnified, and irregularly too, so that what has been put into the tank as a very small and finely shaped fish, in an instant becomes a giant more or less deformed. This kind of tank is the usual one adopted by those who are making an aquarial collection for the first time, and it

answers many purposes admirably; it is sufficiently transparent, moderately strong, and quite cheap. One having a diameter of twelve and a half inches, with a depth of eight inches, and of good thickness, can be bought for two dollars and a half; the knob on the top will prevent its standing steadily, and to obviate this difficulty a stand can easily be turned from a block of wood, with a hole cut in the centre large enough to admit the knob, and allow the bottom of the glass to rest upon it as a support. If properly taken care of, a tank of this sort will last for years, and be a great comfort to its possessor, but an untimely accident will before long induce him to try something more substantial.

Perhaps the best tank for the aquarium in use is what is called a rectangular tank, having the four sides of glass, and the base of some hard material such as stone, iron or wood. The glass is held in place, and supported at the four corners by as many pillars of iron or wood, which are held together on top by strips of a similar material connecting them. Of the three materials for the base and pillars, iron is by far the best for a fresh-water tank, if we can have but one material alone; it is lighter than stone, and the little it rusts from time to time does not amount to anything; the water does not ooze through it as it does through some kinds of stone, and it does not warp, as wood is so apt to do if the tank is left without water for a length of time. To prevent rusting a layer of cement may be spread on the bottom of the tank inside, and a plate of thick strong glass placed upon it; and in the same way a narrow strip of glass can be cemented to each of the pillars, so that the iron shall be prevented from coming in contact with the water at every point. A tank, having a base of slate and pillars of iron protected by glass, as just explained, is the best kind of a tank to own, as it can be used for either salt or fresh water as we require. The shape of a tank, too, is of some importance, that of a double cube being the best for this reason, that it allows more of a clear surface on the long sides for inspection after the rock-

work and plants are introduced, than a tank whose shape is square; it also gives a better chance for the light to strike upon every point inside.

The facilities for procuring tanks already made are so great nowadays, that while once it was an object to know how to construct a tank for one's self, now one has only to make a choice from several patterns. The most important thing to look after in selecting a tank, next to its material and shape, is the kind of cement which has been used; all sorts of putty are to be rejected as worthless; if we cannot be sure that the cement is good and not injurious to fishes, a few weeks trial, or even less, will convince us of its value. Another point to be attended to, is that the cement be quite hard before the tank is filled with water, as there are some kinds of cement used that never harden; of course, in these cases there is danger of having a leaky tank to contend with.

Of the other kinds of tanks, either those made wholly of clay, or of glass, or those with one side at an angle of 50° with the base, so as to form a beach, after the pattern of the Warington tank, or those with all the sides of slate, in imitation of a rock pool, or those of an oval or hexagonal shape, each has its advocates. Some tanks have been lately made in New York, with the base and pillars of a composition which is silver-plated; they are wonderfully light and beautiful, but there seem to be doubts as to their durability. More or less ornament can be displayed on the pillars and base of the tank, according to the taste of the owner, but it seems as if simplicity and neatness were full as requisite here as elsewhere, and that the ornament of the tank should be the collection inside. As to the size of the tank, it very much depends on the place one has to put it in. These three sizes I have found from experience very useful:

No. 1, Length, 18 in.; depth, 10½ in; width, 12 in.

No. 2, Length, 24 in.; depth, 14 in.; width, 14½ in.

No. 3, Length, 28 in.; depth, 13½ in.; width, 13 in.

Number three is, perhaps, the best size of all, and it is by

far the prettiest shape. Tanks can be purchased, generally, at the bird or plant stores of large cities; the prices range from six dollars upwards. Sometimes a stand for the tank is made in connection with it, or of a similar material. It is well to remember in selecting a stand, the enormous weight which it will have to bear when the tank is filled with stones and water.—*To be continued.*

HINTS ON TAXIDERMY.

BY C. A. WALKER.

Equipment for the travelling collector.—The travelling collector should equip himself with a double-barrelled gun (and a rifle when large animals are sought for), ammunition, including shot for small birds and mammals (numbers 2, 6, 8, and 10,—the latter should never be omitted); dissecting instruments, scissors, needles and thread, preservative drugs and preparations, and alcohol about 80 per cent. in strength; tin cans of various sizes for containing alcoholic specimens, since glass bottles and jars are liable to be broken during transportation; cotton and tow for stuffing the skins of birds and mammals; fishing lines and hooks, casting net, a seine for catching fishes in small streams, the two ends of which should be secured to long wooden handles, which are held in the hands of two persons upon opposite banks; in this position it can be drawn both up and down the stream. He should also carry with him a geological hammer and steel chisels for collecting fossils and rock specimens, and small pocket vials and cork-lined boxes for insects.

Preservatives.—Common powdered arsenic should be employed for skins to be mounted at once, instead of arsenical soap, as it has a tendency to dry them quickly. It may be applied dry, or mixed with alcohol until it is of the consist-

ency of syrup; in the former case it should be dusted upon the skin by means of a small sieve; in the latter it is necessary to apply it with a brush. Arsenical soap should be used only upon skins which are intended to be kept for a long time before being mounted. It is composed of the following ingredients: powdered arsenic ½ lb., camphor 1¼ lb., salts of tartar 3 oz., powdered lime 1 oz., bar soap ½ lb.

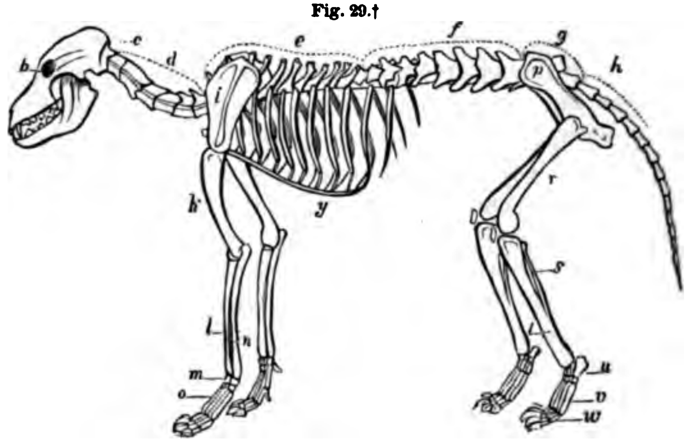
The soap should be cut into very fine slices, put into a tin dish with warm water, and stirred over a moderate fire until thoroughly dissolved; the powdered lime and salts of tartar should then be added and mixed with the soap. The preparation should next be removed from the fire, the powdered arsenic, and lastly the camphor (powdered and dissolved in a little alcohol) added, stirring the mixture all the while. The whole should have the consistency of flour paste; if it be too thick add a little water, taking care not to hold it over the fire after the camphor has been added, as heat will cause the latter to evaporate speedily. After cooling it place it in a jar with a brush passing through the stopper, and label the jar "*poison.*" In extreme cases when the above preparations cannot be obtained, the skin should be rubbed with salt or with alum, or filled with spices and strong smelling herbs. These are by no means a substitute for arsenic, and are to be used only when the latter cannot be obtained. The skins of large animals should be soaked in a solution of alum, arsenic and salt, or in weak arseniated alcohol for several days.

Directions for preliminary work.—When a specimen has been killed the mouth should be opened, cleaned and filled with cotton or tow; the nostrils and vent, and any wounds should be treated in the same way to prevent blood or other secretions from exuding. It is essential to remove the skin as soon as possible after death. Should this be inconvenient, the internal organs should be taken out and the cavity filled with powdered charcoal if it can be had, if not, salt should be used. Previous to removing the skin, an accurate meas-

urement should be taken of the subject in the manner indicated below.*

The color and general character of the hair, as well as any change of the same at different seasons of the year, the sex, and any other peculiarity known should be carefully written

Fig. 29.†



down and preserved. Skins should never be packed for transportation until thoroughly dry; they should then be placed in a box containing plenty of camphor, having its sides and joints perfectly closed with pitch to prevent the invasion of insects. It is well to saturate the inside of the box with benzine before placing the skins within. Never allow a box containing skins to be placed in any damp place.

Instruments and materials used.—Of instruments and materials useful to the taxidermist in mounting mammals, birds, fishes and reptiles, the following are needed: A scalpel

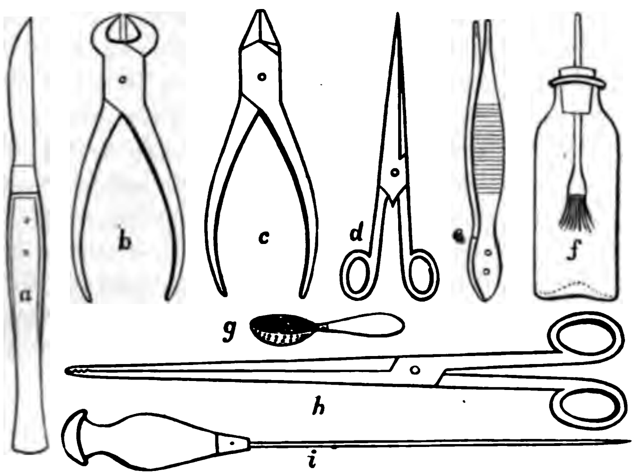
*The following are the general measurements which should be taken of a quadruped:

Total length; nose to occiput; nose to eye; nose to ear; nose to end of tail; length and width of ears; tail from root to end of vertebræ; tail from root to end of hairs; length of the different joints of the forelegs; length of the different joints of the hind legs; forefeet from wrist; hind feet from heel; length of toes; length of nails.

†Explanation of Fig. 29:—*b*, eye; *c*, occiput; *d*, cervical vertebræ; *e*, dorsal do.; *f*, lumbar do.; *g*, sacral do; *h*, caudal do; *i*, scapula; *k*, humerus; *l*, radius; *n*, ulna; *m*, carpal bones; *o*, metacarpal bones; *p*, pelvis; *r*, femur; *s*, fibula; *t*, tibia; *u*, tarsal bones; *v*, metatarsal bones; *w*, phalanges.

(Fig. 30, *a*); a pair of pincers for bending wire (*c*); a pair of wire cutters (*b*); a pair of small forceps for stuffing the necks of *small* birds and mammals and arranging feathers (*e*); a pair of larger ones, at least fifteen inches long, for stuffing the necks of *large* birds and mammals (*h*); a pair of dissecting scissors for cutting flesh and ligaments during the process of skinning (*d*); another larger and stronger pair for cutting tow; a large knitting needle inserted into a handle and sharpened at the end, for perforating the tarsi of birds previous to the insertion of the wires (*i*); a tin sieve with a cover for dusting powdered arsenic upon the skin (*g*); a wide-

Fig. 30.



mouthed jar, with a brush passing through the stopper, for holding arsenical soap (*f*); tow for stuffing small birds and mammals (the finest quality being used for filling the necks); also hay, dried moss, etc., for those of larger size; needles for sewing up incisions; thread for winding; a large fish-hook with the barb filed off, for suspending specimens while skinning them. Annealed iron wire of various sizes, varying from 10 to 26,—No. 10 being used for supporting large specimens, No. 26 for humming birds, warblers, etc. A flat file of medium coarseness for pointing wire; a set of Aiken's

tools, containing various sizes of bradawls; a small gouge, chisels, etc., will be found very useful.

Method of skinning a mammal.—When an animal is ready for skinning, the mouth, nostrils and shot holes, should be filled with cotton or tow. Place the animal upon its back, take the scalpel in the right hand and with the left separate the hair to the right and left in a line from the front of the pubis quite down to the vent, so that the skin beneath can be plainly seen. Make a longitudinal incision along the course, directed in as straight a line as possible, taking care not to cut so deep as to expose the intestines. The skin should then be turned back on either side with the aid of the scalpel, working downward toward the back. When the thigh has been laid bare sever it from the pelvis at its junction with the femur or thigh bone. Layers of cotton or tow should, from time to time, be placed between the skin and body, as it will prevent the hair from being soiled. This operation should be repeated with the other side. Next the intestinal canal should be cut off a little way above the anus, and the tail separated close to the body. The skin should then be loosened from the back and breast until the forelegs are visible. Sever these at the shoulder joint or the base of the humerus. Remove the skin from the neck and the back part of the skull will appear. In skinning over the skull, care should be taken to sever the ears as close to it as possible; also not to injure the eyelids or cut too close to the lips. The carcass should next be separated from the skull at the first vertebræ, or the junction of the skull and neck. The next operation is to remove the tongue, eyes, and all the muscles attached to the head. Through an opening in the occipital bone, carefully clean out the brain. Next the legs should be skinned quite down to the claws of the feet, removing all muscles, but leaving the ligaments and tendons of the knees. The hind legs should undergo the same operation. Lastly, skin the tail as far back as the first three joints of the vertebræ, and to this stump fix a

stout cord, which should be fastened to a hook or other projecting object on the wall. A strong piece of wood is then prepared, flat, and sharpened upon both edges. This should be introduced between the skin and the vertebræ, and by working it around the latter, the attachments will be severed and the vertebræ within can be easily pulled from the enveloping skin. In skinning the tail of the beaver an incision should be made upon the under side, running lengthwise from the base to the tip. The skin should then be loosened, beginning upon either side of the incision, until the flesh is entirely free, when it can be removed, the arsenic added, the skin restored to position, and the incision sewed up.

The foregoing method is practiced only upon the smaller quadrupeds; with the larger mammalia a different course is pursued. An incision is made from beneath the under jaw, in a straight line to the anus; transverse cuts are also made, running down the inside of both fore and hind legs. These being made upon the inner side will render the seams less conspicuous after the specimen has been mounted. To detach the hoofs, place them upon a stone and strike them repeatedly with a mallet; they will soon loosen and can be separated from the bone. After the operation of skinning has been completed, every part of the skin should be anointed thoroughly with arsenical soap. Turpentine applied to the nostrils and lips will prevent the approach of noxious insects. When the skin is too large for the application of the soap, it should be thoroughly saturated with a solution of "alum and water." The different bones left in the skin should all be thoroughly anointed with the preservative, and the eye-sockets and cavity of the brain filled with cotton or cut tow before replacing the skull in its natural position. If the animal be not too large the carcass should be preserved, as it will greatly aid the operator in his work of modelling a body. If immersed in alcohol, it can be kept any length of time.

To mount the skin; for instance that of a squirrel.—First

provide yourself with tow, cotton, thread and twine; also, the stuffing forceps, a pair of pincers, file and wire cutters. With the aid of the forceps supply the various muscles of the face and head, by inserting cotton both through the mouth and eyelids. Take annealed wire of the proper size, and cut from the coil six pieces: No. 1, two or three inches longer than the total length of the body; Nos. 2 and 3 for the forelegs; Nos. 4 and 5 for the hind legs; each of these should be two, or even three inches longer than the limbs they are to support; No. 6, for a support to the tail, of the same proportionate length as the others. With a large pair of scissors, cut fine a quantity of tow, and with this, and the aid of the long forceps, stuff the neck to its natural dimensions. Taking wire No. 1, bend in it four small rings, the distance between the two outer representing the length of the body taken from the skin (Fig. 31, *a*), leaving one long end for a support to the head and neck (*b*). Mould tow about that part containing the rings, and by winding it down with thread, form an artificial body, resembling in form and size the natural one taken from the skin. Sharpen the projecting end to a fine point with the file,

Fig. 31.

and insert it up through the cut tow in the neck, and thence through the skull; the skin should then be pulled over the body. Wires Nos. 2 and 3 should then be placed in position, by inserting them through the soles of the feet, up within the skin of the leg, and through the body of tow, until they appear upon the opposite side. With the pincers bend over the end of each, forming a hook; the wires must then be pulled backwards, thus fastening the hooks firmly into the body. The loose skin of the limbs should then be stuffed with cut tow, taking care to imitate the muscles of the living subject. Nos. 4 and 5 can be fixed in position after the same manner, except if the animal is to rest entirely upon its tarsi (as in

the case with the squirrel when feeding), then the wire must be inserted at the tarsal joint instead of the sole of the foot. If any depressions appear in the skin they must be stuffed out with the cut tow. Wire No. 6 should now be inserted at the tip of the tail, and forced down within the skin, hooking it into the body in the same manner as the leg wires. Stuff the tail to its proper dimensions, with cut tow, and carefully sew up the incision along the abdomen. Having prepared a board about three-quarters of an inch thick, pierce in it two holes at a proper distance apart for the reception of the leg wires (four holes would be needed if the animal were to stand upon all extremities); these must be drawn through upon the under side until the feet of the specimen rest close upon the upper surface, then they should be clinched, taking care that the wire does not protrude above the surface of the board as it renders the support unsteady. The different joints of the limbs can now be imitated by bending the wire at the proper points; also, a curve can be given to the back, and the tail can be set into proper position by simply bending the wires into the required shape. The eyes should now be placed in their position, a little putty having been previously inserted within the eyelid to serve as a cement. Care should be taken in arranging the eyelid, for the expression depends altogether upon this point. Clip off any superfluous wire which may extend above the head with the wire cutters. The specimen should then be placed in some locality free from moisture and allowed to dry thoroughly, when it is complete for the cabinet.

In mounting quadrupeds of large size the following formula should be pursued:—Procure a bar of wood, an inch thick and two inches broad, of a length equal to the distance between the shoulders and thighs; this should be placed within the skin, three holes having been previously made at one end, and two in the other, with a gimlet, for the reception of the various wires. This is used as a

substitute for the central wire or body support. Having sharpened a piece of wire large enough to firmly support the specimen, force it down through the skull and neck, passing it through the gimlet hole at *a* (Fig. 32); when it appears on the under side bend the end into the form of a hook with the pincers, and drive it firmly into the wood. Next, the foreleg wires, well sharpened, should be forced up through the soles of the feet, and fixed into the bar of wood at *b* and *c*, in the same manner as the head support. Do the same

Fig. 32.

with the hind leg wires, fastening them at the lower part of the bar, as at *d* and *e*. Lastly, the tail support should be placed in position, fastening it to the wooden bar at the point *f*. This completes the framework. A quantity of hay or moss should now be procured, and it is of the utmost importance that it should be thoroughly dry, otherwise the specimen is liable to mould. Commence filling the neck, keeping the wire in the centre of the material, and stuff downward to the forelegs; these should then be restored to form, taking care to imitate the muscles of the shoulder. In working down the body place the hay or moss between the bar of wood and the skin to avoid all stiff appearance; always place the stuffing material evenly within the skin, and never use pressure, as a fresh skin can be easily expanded far beyond its natural dimensions. Having reached the hind legs, imitate faithfully, by stuffing, all the natural muscles. When this part has been completed, sew up the various incisions; attention should be paid to separating the

hairs, and not to take any of them in along with the thread. Imitate the joints of the limbs by bending the wire at the proper points, and place the specimen upon the board, draw the wires through the holes with the pincers, and clinch them upon the under side. The specimen will then assume an erect position. The orifices of the eyes, mouth and ears, should be filled with cotton saturated with the preservative, and the artificial eyes put in while the eyelids are yet pliable. The lips can be secured in their proper position by means of pins, and the nostrils distended to their natural size, with pellets of cotton inserted within. In the larger mammalia the orifices of the head should always be anointed with *spirits of turpentine*. If any irregularities appear in the skin, they must be pressed down and modelled into shape with the hand. The muscles of the various parts of the body can be exactly imitated by making casts of plaster of Paris, and fitting them within the skin in lieu of other stuffing material.

Those gigantic beasts which roam about the forests of tropical countries, such as the elephant, giraffe, etc., have to be mounted upon wooden models. Perhaps the method cannot be better illustrated than by giving an account of the manner in which an elephant was mounted at the Jardin du Roi, at Paris, as related by Capt. Thomas Brown, F. L. S., in his work entitled "The Taxidermist's Manual:"

"The dead elephant being extended on the ground, the dimensions were all taken and correctly noted at the time. M. Lassaigne, cabinet-maker to the establishment, invented a large rule for that purpose, which was somewhat like a shoemaker's size-stick. The different curves of the back, belly, neck, etc., were taken by bars of lead, of three-quarters of an inch in thickness. This metal is much better adapted than any other for that and similar purposes; as it has no elasticity it retains any shape into which it is put. M. Demoulins made a drawing of the animal from these measurements, on the wall of the workshop where the model was constructed, of its natural size. The elephant was placed upon its back by means of four-corded pulleys fastened to the platform. An incision, in the form of a double cross, was then made in the lower side, the central line reaching from the mouth to the anus; the two cuts were made from the left leg, on both sides, to the opposite right legs. The trunk was

longitudinally opened on its under side; the soles of the feet were now taken out to within an inch of their edge, and the nails allowed to remain attached to the skin. This was effected by the aid of a chisel and mallet, and was one of the most difficult operations of the whole. Several persons wrought at a time at the operation of skinning, and four days were necessary to effect it. When removed from the carcass, the skin was weighed, and found to be five hundred and seventy-six pounds. It was extended on the ground, so that the cutaneous muscles of the head and other parts might be cut away from its interior. The skin was then put into a tub, and covered six inches deep with water which had been saturated with alum. The model which was to fill the skin was made as perfect as possible in its shape. To insure this, models were made of half the head in plaster, as also a fore and hind leg. This structure was made of linden wood, and so ingeniously constructed by M. Lassaigne, that almost the whole parts could be separated. He opened a panel on one side of the body, whereby he introduced himself into its interior, so that he might make its parts more perfect within. Even the head and proboscis were hollow, which rendered this stupendous model so light that it could be moved from one place to another with comparative ease. The model being completed, the alum water, in which the skin had been all the time immersed, was now taken out and made boiling hot, and in that state poured on the skin, which was then allowed to soak in the warm liquor for an hour and a half, when it was taken out, still warm, and placed upon the model, which was accomplished with some difficulty. But judge of their own mortification when it was found that the model was rather too large. To diminish the woodwork they foresaw would run the risk of putting its parts out of proportion. It then occurred to them that the best thing to be done under these awkward circumstances was to take off the skin again, and reduce its thickness with knives; they removed all the internal thickenings which came in their way. In this operation five men were occupied for four days, during which time they cut out one hundred and ninety-four pounds weight off the internal surface. During this process the skin had dried, and required again to be immersed in cold soft water; after allowing it to remain twenty-four hours to soak, it was then put on the model, and found to cover it completely; the edges were brought together and secured with wire nails, deeply driven home, and large brads. Except at the edges, the nails and brads were only driven in half way, to keep the skin down to the different sinuosities and hollows until dry, when they were again all pulled out. The alum with which the water was saturated gave the skin an ugly gray appearance from crystallization. But this was soon remedied, by first rubbing the skin with spirits of turpentine, and afterward with olive oil. By the admirable and well executed contrivance here adopted, a specimen has been mounted with all the appearance of life, which, with a little attention, may resist for ages the influence of time."

[*To be Continued.*]

REVIEWS.

THE ORIGIN OF GENERA.*—In this essay the author does not consider that generic and specific characters are identical. He divides animals into numerous series, specific, generic and so on, in which the lower members of each form the progressive steps, with the exception of course of the specific series. "The lowest or most generalized terms or genera of a number of allied series, will stand to each other in a relation of exact parallelism. That is, if we trace each series of a number, up to its lowest or most generalized genus, the latter together will form a series similar in kind to each of the sub-series, *i. e.*, each genus will be identical with the undeveloped conditions of that which progresses the farthest, in respect, of course, to the characters which define it as a series." Cases of exact parallelism are accounted for by the law of "retardation and acceleration," which is claimed to be "a continual crowding backwards of the successive steps of individual development, so that the period of reproduction" "falls later and later in the life history of the species, conferring upon its offspring features in advance of those possessed by its predecessors."

Prof. Cope here points out a parallel between the development of the individual and of the genus of great interest and novelty. "As one or more periods in the life of every species is characterized by a greater rapidity of development (or metamorphosis) than the remainder, so in proportion to the approximation of such a period and the epoch of maturity or reproduction, is the offspring liable to variation. During the periods corresponding to those between the rapid metamorphosis, the characters of the genus would be preserved unaltered, though the period of change would be ever approaching." "As the development of the individual, so the development of the genus. We may add so the development of the whole of organized beings."

After stating that as a rule animals exhibit in course of development certain specific, before they do generic, characters, the author says: "Apart from any question of origin, so soon as a species should assume a new generic character, it ceases, of course, to be specifically the same as other individuals which have not assumed it. If supposed distinctness of origin be, however, a test of specific difference, we shall then have to contend with the paradox of the same species belonging to two different genera at one and the same time." Several instances then are brought forward to prove the proposition "that the nearest species of adjacent genera are more nearly allied in specific characters than the most diverse species of the same genus," and, also, that like varieties of distinct species are much nearer in shape and appearance than unlike varieties of the same essential species." In course of time a series is formed in which

*The Origin of Genera. By Prof. E. D. Cope. Philadelphia. 8vo, pp. 80. $1.25.

the adult characteristics of the original genus are reduced to a larval condition, but the original genus still continues to "accelerate" its own development, though more slowly, and finally reduces its original characteristics also to a larval condition, and acquires in the adult state different characteristics from the first series.

This, with other confirmatory evidence, renders it probable that generic changes may simultaneously take place in a number of species without the loss of their specific characteristics, and in the same way genera may be simultaneously transferred from one suborder to another without the loss of their generic characteristics. The development of generic characteristics thus appears to be governed by a law which is not dependent upon physical surroundings. Species on the other hand, though they "exhibit a proportion of characters which are the successive stages of that one which progresses farthest," yet "the majority of specific characters are of divergent origin,—are "morphic as distinguished from developmental.* Thus specific characteristics are essentially adaptive, and therefore due mainly to natural selection. The author's conclusions are given in six propositions, from which we quote the two given below:

I. Species have developed from preëxistent species by an inherent tendency to variation, and have been preserved in given directions and repressed in others, by the operation of the law of Natural Selection.

II. Genera have been produced by a system of retardation or acceleration in the development of individuals; the former on preëstablished, the latter on preconceived lines of direction. Or in other words, while nature's series have been projected in accordance with the law of acceleration and retardation, they have been limited, modified and terminated by the law of natural selection, which may itself have operated in part by the same law.

An Illustrated Work on the Butterflies of New England.—Mr. Samuel H. Scudder will publish during the coming winter, a large and expensively illustrated work upon New England Butterflies. He will give, as far as possible, a complete history and description of each species during every stage of its existence; tables and descriptions of genera will be introduced, together with a preliminary chapter upon the general structure of butterflies, which will serve as a guide to their careful study; their geographical distribution, both in and out of New England, will be largely discussed, and the book virtually form a manual for all the Northern United States; it will be generously illustrated by colored plates of every species, done in the highest style of the art.

To make the work as complete as possible, the author invites the assistance of entomologists in obtaining living or fresh specimens of eggs, larvæ and pupæ, for illustration and study. Without such assistance it would be impossible, in a single summer, to obtain all the requisite material. Full credit will be given in the book for every item of assistance rendered.

The success with which Mr. Saunders, of Canada, has reared butterflies in their earlier stages, ought to encourage our friends to similar

efforts. Mr. Saunders' method is to confine each female butterfly in a small, dark box,—a pill box for example,—in which she is obliged to deposit her eggs; he endeavors, before the eggs are hatched, to notice what plant the butterfly seems to affect; the young larvæ are fed upon it, and, in many instances, successfully reared.

As careful descriptions of these larvæ and pupæ cannot be prepared without many specimens, and as we have so little accurate knowledge of the earlier stages of our native butterflies, our friends need not fear to send Mr. Scudder all the specimens they can find. If possible, they should be sent alive, so as to secure good colored drawings of each species; the larvæ should be accompanied by fresh, moistened leaves of their food plant for nourishment on the journey, and forwarded by mail in small, light, but strong boxes (tin is preferable), to S. H. Scudder, Boston Society of Natural History, Berkeley street, Boston, Mass., marked in addition, *Insects*. This latter precaution is necessary, because, in case of a temporary absence from the city, Mr. Scudder will leave directions to have boxes thus marked, sent at once to his artist. The specimens should be accompanied by the name and address of the sender, and, when known, the name of the insect and of the plant on which it feeds. When it does not seem practicable to forward them alive, they may be sent in small bottles of glycerine, or in a mixture of one part pure carbolic acid (Squibb's preparation), and twenty-four parts water. In this case also they should be sent at once and by mail, that the colors may be seen before they fade. When neither of these methods is possible, spirits may be used, but the colors will soon be lost. If any one obtains a number of eggs and is able to raise them, it would be best to forward, from time to time, two or three specimens both of the eggs and chrysalids, and the same number of *each moult* of the larva; the butterfly which has laid the eggs should always be preserved, and forwarded with the larvæ, etc., for satisfactory identification. If any one is in doubt about the food plant of some insect which he has found, it would be best to write a letter of enquiry to Mr. Scudder, who will be glad to answer any questions.

Those willing to assist in this work should commence at once to trace the history of the Theclæ and Lycænæ, of which almost nothing is known. The former feed upon various trees and shrubs, such as the oak, thorn, willow, pine and cedar, and also on the hop-vine; the latter upon different kinds of herbs, as Lespedeza, etc.

The author trusts that those who live outside of New England, will remember that he must depend absolutely upon them for information concerning the earlier stages of those insects which are very rare in New England, but common with them. Any assistance that they can render him will be most gratefully received.

THE KINGFISHERS.—A monograph of this beautiful family of Birds is now being published by Mr. R. B. Sharpe, of the Zoölogical Society of London. It will be issued in twelve to fourteen parts, imperial 8vo, each part to contain eight beautifully colored lithographic plates. All the species

of Kingfishers known (about one hundred) will be described and figured, and Dr. Murie will furnish a chapter on the anatomy and osteology of the family. Only two hundred copies of the work will be printed: three parts are already issued. The price to subscribers will be about $5.00 a part, delivered in this country. The work is worthy of support by the ornithologists of this country, and we should be happy to take subscriptions for the author. The price will be advanced one-fifth after the work is out.

Bulletin of the Essex Institute.*—This new publication of the Institute is one of the results of the changes that have taken place owing to the formation of the Peabody Academy of Science, and the transfer of the Scientific Museum of the Institute to the charge of the Academy. In great part the "Bulletin" will take the place of the "Proceedings and Communications" of the Institute, which will be discontinued after the publication of Volume *six* (now in press), which will bring the Proceedings up to the month of January, 1869, at which date the "Bulletin" commences.

The "Bulletin" will contain an account of the proceedings at each meeting of the Institute, and the lists of donations, etc., made to the library of the Institute, and to the Museums of both the Institute and the Academy. It will also contain short lists of the deficiencies in the library of the Institute, and of duplicate books offered for sale and exchange, but by far the greater part of each number will be devoted to the short communications read at the meetings, and of general interest, while the longer historical papers will be printed as heretofore in the "Historical Collections," and the purely scientific communications will be offered to the Academy for publication in its Memoirs. It will thus be noticed that the "Bulletin" will take the place of the "Proceedings," while the Memoirs of the Academy will correspond to the former "Communications" of the Institute.

The first number of the "Bulletin" contains, among other interesting papers, the remarks made by Prof. A. M. Edwards at a recent meeting, on Guano, in which Prof. Edwards advances the theory that guano is not the droppings of birds, as has generally been supposed, but is the deposit of the remains of dead animal and vegetable matter at the bottom of the ocean, which, as the coast rose, had been so lifted as to appear on the crests of the islands formed, and from the chemical changes it had undergone, had become guano. Among other facts brought forward to prove his theory, he mentioned that an island had risen at the Chincha group, which contained guano on its summit at the time of its uprising. He also alluded to the fact that the droppings of birds would be quite inadequate to supply the vast amount of guano found, and that such droppings were chemically distinct from guano.

The first and second numbers of the "Bulletin" contain obituary notices of our late associate, Horace Mann, and of the distinguished ornithologist, John Cassin.

*8vo, 16 to 20 pages. Issued monthly. Price 10 cents single copy. Subscription $1.00 a year. Essex Institute Press.

THE CRANE-FLIES OF NORTH AMERICA.* — Another of the useful entomological works issued by the Smithsonian Institution, is Baron Osten Sacken's elaborate Monograph of the North American Tipulidæ (or Crane-flies), with short palpi, comprising the smaller species of the family; the true Tipulids comprising the well-known crane-flies so abundant in our gardens and fields. This work, destined, we judge, to be a classic in American entomological literature, is useful not only as containing descriptions of all our known crane-flies, but as a model of the mode of monographing a group of animals; and for patient research, thorough treatment and the new mode of illustration (heliographs by Egloffstein's patent) is one of the most important works on insects published during the past year in any language. It will be noted at greater length in the "Record of American Entomology" soon to be published.

REVISION OF THE LARGE, STYLATED, FOSSORIAL CRICKETS. — In the first number of the *Memoirs of the Peabody Academy of Science*,† Mr. S. H. Scudder has brought under review all the species of the palmated crickets known to him, with the exception of the smaller forms. The descriptions of the species are carefully prepared, and each description is accompanied with a full table of measurements of several specimens. The plate contains a full-sized figure of *Gryllotalpa australis*, from New Holland, a species never before figured; and thirty-seven details of forelegs and wing-covers of the different species.

The author has prefaced his own descriptions with a full list of the various writers on the group, with remarks on the species mentioned by each. The Mole Crickets which are furnished with but two dactyls on the fore tibia, he places together as forming a new genus, to which he gives the name of *Scapteriscus*, while for those having four dactyls, he retains the old generic name of *Gryllotalpa*.

THE NOXIOUS INSECTS OF MISSOURI.‡ — This first report of the State Entomologist is exceedingly creditable both to the author and the State which has so liberally fostered the study of economical entomology. Farmers and gardeners throughout the country will find it a very readable book, and entomologists will glean many new facts from its pages. The chapter on Cutworms, Bark-lice, the Plum-curculio, the Seventeen-year Cicada, the Potato-beetles and the Bot-fly of the sheep, are of especial interest.

We learn that the State of Missouri has acknowledged the value of the study of practical entomology, by the appropriation of $3000 to pay the salary of the Entomologist for the present year. In such a liberal provi-

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* Monographs of the Diptera of North America, Part. IV. (Smithsonian Miscellaneous Collections, 219). Prepared for the Smithsonian Institution by Baron Osten Sacken. Washington, Jan., 1869. 8vo, pp. 345, 4 plates.

† Imperial 8vo, 32 pages and steel plate; tinted paper. Salem: Essex Institute Press. March, 1869. Price $1.25.

‡ First Annual Report on the Noxious, Beneficial and other Insects of the State of Missouri. By Charles V. Riley, State Entomologist. Jefferson City, 1869. 8vo, pp. 190, with two colored lithographic plates and ninety-eight cuts, $2.00; with plain plates $1.00.

sion for the diffusion of entomological knowledge, Missouri not only leads all the States in the Union, but shows that she regards it as an economical measure to induce every farmer to be his own entomologist.

GUIDE TO THE STUDY OF INSECTS.* — The sixth number of this work is out, and contains accounts (not before published) of the transformations of twelve moths injurious to fruits, etc., mostly illustrated, besides notices of the Clothes' Moth, Carpet Moth, Grain Moth, the Angoumois Grain Moth, etc., with full directions for collecting the smaller moths. The chapter on Diptera is begun, and gives accounts of the Mosquito, the Wheat Midge, Hessian Fly and Gall Flies. The number contains a steel plate figuring forty different objects, and fifty-seven cuts in the text. We should here state that the *Penthina vitivorana* feeds exclusively on the grape seed; it rolls up the leaf when about to transform, but does not *feed* upon it. Lines eight and nine from the bottom, on page 336, may therefore be deled.

LE NATURALISTE CANADIEN.† — A capital journal for the popularization of natural history among the French Canadians. It is edited with much spirit, and we trust that its success is already assured.

TERATOLOGY. — M. C. Dareste has given us in the "Annales des Sciences Naturelles" a résumé of his remarkable discoveries, from which we translate a few paragraphs as nearly word for word as possible:

"I at first sought to obtain monstrosities, as Geoffroy Saint-Hilaire had done, by submitting eggs placed vertically or partially varnished to artificial incubation." "Later I recognized the fact that these two causes which I had set in operation were not the only ones which acted upon the embryo, and that it was necessary also to take account of another cause to which I had not at first attended; that is to say, of the manner in which the eggs were heated in one of the artificial 'couvenses,' which have served for my experiments. I have therefore, provisionally, abandoned the use of varnish, and the vertical position, in order to employ only a single cause of modification, the use of which I could perfectly control." When the egg is covered with varnish or other glazing, which partially excludes the air, the embryo can develop, but finally perishes when the allantois is formed "when the needs of respiration imperiously demand greater quantity of air." "I arrive now at the results which depend upon the mode of warming the eggs in one of my artificial brooding hens (couvenses). In this apparatus the contact of the egg with the source of heat takes place by only one point. Now if in place of directly warming the culminating point of the egg, the point which the cicatrix always occupies at the end of the development, a point of the egg situated at a certain distance from the preceding one be heated, the development is

* Published at Salem, Mass., by A. S. Packard, Jr. Fifty cents a part. To be published in ten parts.

† Le Naturaliste Canadienne. Bulletin des Recherches, Observations et Decouvertes se rapportant a l'histoire naturelle du Canada. Tom. I, nos. 1-4, 1869. Quebec. 8vo, $2.00, gold, with illustrations.

disturbed, and an anomalism is always produced, which manifests itself in the form of the blastoderm at first, and then in that of the vascular area. In fact, under these unusual conditions, the development of the cicatrix takes place more rapidly in the region lying between the culminating point of the egg, and the point of contact with the source of heat, than in the opposite region. On this account (Il en résulte qui) the blastoderm at first, and then the vascular area assumes an elliptical form, and the embryo is produced in one of the foci of the ellipse; while in its normal state the embryo occupies the centre of a perfectly circular blastoderm and vascular area. This result is very distinct, so distinct that allowing for the primitive eccentricity ("l'orientation") of the embryo, and giving to the egg a certain position with respect to the source of heat, this excess of development of a part of the blastoderm may be directed where it is desirable, either to the left or the right of the embryo, either above its head or at its caudal extremity."

"The embryos which appear in the blastoderms thus formed are very frequently monstrous. I cannot say in what proportion however, since I am often obliged to study them at an epoch anterior to the appearance of a monstrosity, and I cannot therefore predict what would have taken place if incubation had been continued. However this may be, I have thus been able to observe almost all the types of simple monstrosities at different epochs in the formation of the embryo, and consequently to bring together the materials of teratological embryogenesis.

"And, first, I have established a very general condition of the formation of the greater number of monstrosities, of those at least which profoundly modify the organization; it is that they appear early, and during that period of life when the embryo is reduced (reduit) to a homogeneous matter, when the general form of the body, and the special form of each organ is sketched out before the appearance of definite histological elements." "Celosoma, Exencephalus and Ectromelia, so different in appearance, but which are almost always associated, have for a common condition an arrest of the general development of the amnios, which does not complete itself always in front, leaving thus the umbilical opening more or less open, and which (the amnios) completing itself only slowly behind, remains for a greater or less time in contact with certain parts of the embryo, which it submits to constant pressure. From this there results a certain number of deviations and atrophies in the regions of the body submitted to pressure.

"Symelia, which has been hitherto considered inexplicable, results from an arrest in development of the caudal hood of the amnios which forces the posterior members, at the moment of their appearance, to reverse themselves backwards, to come in contact with each other by their external edges, and to unite themselves in this universal position. Anencephalism has in the beginning hydropsy of the vesicles which are the first state of the encephalic organs. This hydropsy is found equally in the amnios, and sometimes, indeed, in the whole thickness of the tissues, which then present a general œdema, the result of a peculiar state of the

blood which is completely colorless, and contains only very few globules. The want of globules in the blood has its rise in an arrest of development of the vascular area, which is only very imperfectly furnished with canals, and which presents the blood globules imprisoned in the isles of Wolf (iles de Wolf).

"The inversion of the viscera results from the unequal development of the two cardiac blastemæ, which, as I have discovered, precede the formation of the heart. In its normal state the right cardiac blastema is more developed than the left, and determines ulteriorly the incurvation of the cardiac arch more to the right of the embryo than the returning of the embryo (heart) upon the left side. During inversion, the left cardiac blastema develops itself more than the right, from which results the incurvation of the cardiac arch to the left of the embryo, and the return of the same upon the right side. The existence of two hearts, an anomaly unknown to Geoffroy Saint Hilaire, which M. Panum described some years since, and which I have had occasion to observe several times, results from an arrest of development which prevents the junction of the two primitive cardiac blastemæ. Cyclopia results from an arrest of development which prevents the two ocular blastemæ, primitively in contact, from separating themselves. This arrest of development is very probably in consequence of an arrest of development of the cephalic cap of the amnios; but I have not yet been able to establish this last fact with certainty." In fact I have seen that the inversion of the viscera may be obtained when, in one of the malformations of the blastoderm previously indicated, the left region of the vascular area is more developed than the right, and when, also, the temperature of the centre where incubation is effected, is relatively low. I have otherwise accumulated numerous indications which will soon permit me, according to all appearances, to produce at will other anomalies.

"I have made, also, many experiments in order to study the manner in which evolution is carried on at temperatures above and below the normal temperature of incubation. The high temperatures accelerate its progress, and produce that diminution of stature which constitutes Nanismus. The low temperatures, on the contrary, considerably retard the progress of development, and do not permit the embryo to exist (depasser) beyond a certain period.

"It is also a remarkable consequence of my studies that they explain the absence of certain monstrosities in certain species by the differences which these species present in their evolution. Thus the absence of the amnios appears to preserve the fishes from a great number of deformities; the absence of the amnios and that of the umbilical vesicle equally appear to give to the Batrachians a still more remarkable immunity."

NATURAL HISTORY MISCELLANY.

BOTANY.

Lake Superior Plants compared with Eastern specimens. — Not long ago my attention was called by a friend, a distinguished botanist at the East, to the remarkably large and robust development of some of my Lake Superior specimens, as compared with the same species of plants found in the New England States. This is particularly observable in the plants of the earlier part of the season, where one would be led least to expect it. Among the most remarkable are the *Carices*, most of which are in full perfection by the early summer. Of these I would specify the following, a few out of many, as worthy of note in the above respect: — *Carex Backii* Boot, *C. varia* Muhl., in its many forms, *C. Houghtonii* Torr., *C. laxiflora* Lam., and *C. lenticularis* Michx. The Gramineæ, however, exhibit this condition in the most extraordinary degree. The Mountain Rice (*Oryzopsis asperifolia* Michx.) I found in flower and about two feet high by the latter part of May. The Holy-grass (*Hierochloa borealis* Roem. and Schul.), in flower early in June was over two feet high, the leaves, stalk, panicle and its component parts, proportionately large. This fragrant grass the Indian women weave into baskets and fancy articles, which they dispose of to travellers. *Kœleria cristata* Pers., growing in shady woods along rivers, flowered in July, and was rank and tall, often over five feet in height. Several species of *Glyceria* and *Poa* are also worthy of mention as singularly luxuriant. *Triticum violaceum* Hornem., I found on the northern shore of the lake, on the few gravel beaches, where it attained a height of over four feet, having an extraordinarily robust culm. The grain was well formed by the latter part of August, and up to the early part of September the plant was untouched by frosts. This is peculiarly interesting as connected with our cereals, and remembering that our common Wheat (*Triticum vulgare* Linn.) is of the same genus.

The large amount of snow which falls in the region of Lake Superior, and lies upon the land, a great warm blanket several feet thick, undisturbed by the variable temperature which affects other places, but which is unknown there, effectually protects the soil from all frost, and has a marked influence on the vegetation. The snow remains till late, and when it disappears the ground has not the delay of getting thawed out as elsewhere. I have frequently found snowdrifts in the woods from one to two feet deep, which remained well into June under the shade of the cedars, and this when it was unpleasantly warm in the openings. The sun, too, has a greater power there than commonly supposed, almost counterbalancing the shortness of the summer. Violets, which I found in May (*Viola blanda* Willd., *V. Selkirkii* Pursh., etc.), had evidently been blossoming during the winter, which corroborates what an old resident of

Lake Superior told me, viz., that any time during the winter violets could be obtained by digging away the snow. *Adenocaulon bicolor* Hook., I found in June, three feet high, in full blossom, and having almost a tropical luxuriance; and towards the middle of that month *Lathyrus ochroleucus* Hook., twined its elegant wreaths of cream-colored or pale-yellow flowers in graceful profusion. Instances might be multiplied did space permit.—HENRY GILLMAN, *Detroit, Mich.*

ZOÖLOGY.

GLYCERINE FOR PRESERVING NATURAL COLORS OF MARINE ANIMALS. —While collecting on the coast of Maine last summer I made numerous experiments with glycerine, most of which were eminently satisfactory. At the present time I have a large lot of specimens which have the colors perfectly preserved and nearly as brilliant as in life. Among these are many kinds of Crustacea, such as Shrimp and Prawns (*Hippolyte*, *Crangon*, *Palæmon*, *Mysis*, etc.), Amphipods and Entomostraca; also many species of Starfishes, Worms, Sea-anemones (*Alcyonium*, *Ascidians*, etc.). The Starfishes and Crustacea are particularly satisfactory. The internal parts are as well preserved as the colors, and in these animals the form is not injured by contraction, as it is apt to be in soft bodied animals, either by alcohol or glycerine. The only precaution taken was to use *very heavy* glycerine, and to keep up the strength by transferring the specimens to new as soon as they had given out water enough to weaken it much, repeating the transfer two or three times, according to the size or number of specimens, or until the water was all removed. The old can be used again for the first bath. In many cases the specimens, especially Crustacea, were killed by immersing them for a few minutes in strong alcohol, which aids greatly in the extraction of water, but usually turns the delicate kinds to an opaque, dull white color, but this opacity disappears when they are put in glycerine, and the real colors again appear. Many colors, however, quickly fade or turn red in alcohol, so that such specimens must be put at once into glycerine. Green shades usually turn red almost instantly in alcohol. Specimens of various Lepidopterous larvæ were also well preserved in the same manner.

The expense is usually regarded as an objection to the use of glycerine. The best and strongest can be bought at about $1 per pound, but recently I have been able to obtain a very dense and colorless article at 42 cents per pound, which is entirely satisfactory. As there is no loss by evaporation, the specimens will keep when once well preserved, if merely covered by it. The expense for small and medium sized specimens is not much more than for alcohol.—A. E. VERRILL, *Yale College.*

DOES THE PRAIRIE-DOG REQUIRE ANY WATER?—Prairie-dog towns on the Plains are often situated miles away from any water that can be discovered on the surface. It is the general belief among those who are

familiar with the habits of the prairie-dog, that he does not require any more water than is contained in the grass roots on which he feeds. Gen. Marcy, in his "Army Life on the Border," expresses this belief. When the grass is growing, and the roots are tender and full of sap, it is easy to believe that this is the case. It is, however, difficult to understand how sufficient moisture could be contained in the food of the prairie-dog to replace what must be lost in respiration, etc., and to carry on the process of digestion during the months of September, October and November. At this season of the year it is not unusual for from fifty to sixty days to pass without a drop of rain falling. There is no dew, the air is extremely dry, and the short buffalo-grass (often the only thing which grows on the highlands where the prairie-dog villages are commonly found), becomes completely dried down to the roots, while the roots, being but two or three inches underground, become hard and dry.

Tame prairie-dogs are frequently seen to drink water. My belief in regard to the matter is, that in every prairie-dog town there are a sufficient number of wells to supply the inhabitants with water.

In attempting to flood dogs out of their holes for the purpose of obtaining the young ones for pets, I have found some holes that could be filled to the brim with two barrels of water, and from these holes have obtained young dogs. In other holes I have emptied three or four barrels in immediate succession, and instead of filling the holes, have heard the water last poured, continue running with a rumbling noise, deep in the ground, for a minute or more after my supply was exhausted. These holes it seems to me must be deep enough to answer the purpose of wells, and I can conceive of no other object that could induce the dogs to burrow so deeply, than that of obtaining water. They are generally of greater diameter than other holes, and go down straight from the entrance instead of obliquely as do others. While they show signs of being constantly resorted to by the dogs, they do not have the same appearance of being lived in by a family. The excrement of the dogs does not lie around them in such abundance, and the grass near has not been so extensively rooted up for food.

The prevailing belief among frontiersmen, that prairie-dogs, rattlesnakes and prairie owls all live together on friendly terms, in the same hole, is doubtless a mistake. It is founded upon the fact that rattlesnakes and dogs have been seen to come out of the same hole. The snake in such instances had, probably, been after a young dog for dinner. The prairie owl probably finds his food around dog-towns, and makes his home in deserted holes.—George M. Sternberg.

Breeding Habits of Salamanders and Frogs.—There is still a great deficiency in our information concerning the breeding habits of these animals, which many young naturalists residing in the country ought to make an effort to supply this spring. Careful observations made upon any of our frogs, recording the first appearance, the time and place of laying the eggs, the form and appearance of the egg-clusters and how

attached, the duration of the laying period, etc., are all worthy of record, as is also the history of the development of the young, but specimens of every species of which the habits are noted should be preserved in alcohol, so that the species may be accurately determined. The young should be reared, and a full series preserved, with dates.

Concerning the breeding habits of our Salamanders little is known. Mr. Putnam and others have observed the eggs of the Red-backed Salamander, which are laid under rotten wood, etc., in moist places, and are cared for by the mother, who also broods the young when hatched. The young very quickly loose their external gills, and pass rapidly through the tadpole state. Prof. Baird observed a species of Desmognathus which wrapped the eggs around its body, and remained in a moist place until they were hatched. Our common *Desmognathus fuscus*, or Painted Salamander, was observed by me in Maine, where it lives under stones in cold brooks and springs. It attaches its large ivory-white eggs in patches upon the under sides of stones. The young retain their external gills until they are nearly full grown, and at least three inches long in some cases. The eggs of the common Water Newt (*Diemictylus viridescens*) were observed by Mr. S. I. Smith and myself at Norway, Maine, in 1863 and '64, where they were found attached in rounded masses, two or three inches in diameter, and resembling frogs' eggs, on the stems of water plants growing in ditches in a meadow. The eggs were found May 5th, and the young were reared by Mr. Smith. They were hatched May 17th, and by the first of October had become one and a half inches long, with rather stout bodies and broad heads, and still retained their external gills, though they had partially acquired the colors of the adult. The experiment was then discontinued, but the specimens were all preserved.

In this species the male, at the breeding season, clasps his hind legs around the body of the female just behind her forelegs, and from the fact that a pair taken late last fall and kept in confinement were often seen in this position, it is probable that it commences breeding very early in the spring. Under sexual excitement the colors and appearance change considerably. The hind legs of the male become much swollen, and a black callosity forms on the inner sides, which aids in giving firmness to his grasp. These characters soon pass away after the eggs are laid. In salamanders and frogs the eggs and the milt are discharged simultaneously, and the eggs are fertilized in the water. So far as I know nothing has been published concerning the eggs or breeding habits of any of our other species, several of which are very common. — A. E. Verrill, *Yale College*.

The Biter Bitten. — Two or three years ago a student, Mr. William Stone, while on an excursion to Mt. Carmel, a few miles from New Haven, caught a large Black Snake (*Bascanion constrictor*), and brought it home, living and uninjured, except that it was partially suffocated from having been carried by the neck. In consequence of this, probably, it became sick soon afterwards, and vomited a fine specimen of the Copperhead

(*Ancistrodon contortrix* B. and G.), about two feet long, and nearly perfect, except that the head showed signs of incipient digestion. Soon afterward this was followed by a good sized frog, somewhat farther advanced in digestion.

How the Black Snake managed to capture the Copperhead without being bitten is quite a puzzle. Possibly he took the Copperhead at a disadvantage, while he was busily engaged in swallowing the frog and so swallowed both snake and frog together. — *Ib.*

CITATION OF AUTHORITIES. — Without intending to discuss a question which has caused much controversy, I call attention to the fact that after a good genus has been proved, as in taking Unio from Mya, such genera are gradually adopted as occasion offers, and it is sometimes difficult to ascertain who first stated in print the fact known to all, of a given species of described Mya being a Unio.

Mr. Prime in his earliest paper on *Pisidium* (since corrected), cited Gould for *P. dubium* (*Cyclas dubium* of Say), with the synonym *P. abruptum* Hald. (Proc. Acad. Nat. Sci., July, 1841), the latter being the first to give the proper genus. If a painter were to copy a figure of Adam from Angelo, and of Eve from Dubufe, this rule would make him the proper author of both, in the new combination. But the description of *Pisidium abruptum* of July was corrected in October, in the words "*Pisidium abruptum* is not distinct from *P. dubium* Say," which, under this rule, gives me a citation to which I would not have been entitled had I not committed a blunder.

Some authors cite Prof. Baird for the Bluebird (a Linnéan species, *Sialia sialis* (Pacific R. R. Reports, Vol. 9, p. 222, October, 1858); but if the species is not Linné's, it is mine, because I mentioned it fifteen years previously as "The familiar Bluebird (*Sialia sialis*)," in a chapter on the Zoölogy of the State, in Trego's Geography of Pennsylvania, 1843, p. 77.

In the "American Journal of Conchology," Vol. 4, p. 272, a rule is proposed that "the name of the author of a species, or genus, or family, shall remain forever attached thereto, and shall be considered a part of the said specific, generic, or family name." — S. S. HALDEMAN.

THE LOGGERHEAD SHRIKE. — In the September and February numbers of the NATURALIST questions are asked about the Butcher Birds returning to its empaled prey. As I have lived South, I have never seen a Butcher Bird, and so can say nothing as to its habits, but as for its Southern brother, the Loggerhead Shrike (*Collyrio Ludovicianus*), I have often watched it return to the prey which it has killed and hung on thorns. In the month of January last, in the State of Florida, I saw a Loggerhead attack a snake, of the genus *Leptophis*, nearly two feet in length, and after a sharp contest, succeeded in dispatching it. Taking it in his bill, he empaled it on the thorn of an orange tree near by, and leaving it there, flew away. A day or two after, as I was passing by, I noticed that the snake had been more than half devoured. Sitting down behind some bushes near by, I determined to keep watch, but had not remained there

long, when the shrike flew to the tree, and after eating off a small piece, again flew away. I saw this repeated next day, but by this time the remainder of the snake had become dried up and hard, and though I watched several times, he did not return to it. Since then I have often seen them return to lizards and tree toads which they had empaled.—H. S. GEDNEY, *Potsdam, N. Y.*

CASE WORMS.—Every dabbler in pools is acquainted with the singular Caddis or Case-worms, which walk over the bottom like moving sticks, or a mass of animated sawdust, or minute pebbles when the bottom is composed of either of those substances. The most puzzling form is that which we here figure (Fig. 32), received from a correspondent in the Middle States. It is a species of Helicopsyche, and was by some conchologists (I. Lea, Transactions American Philosophical Society, 1834, p. 101) thought to be a fresh-water shell (Valvata). It is extremely interesting as repeating among the aquatic neuropterous larvæ the form of the snail-like terrestrial larva of *Psyche helix*, a moth.

Fig. 32.

Regarding these cases, Dr. Hagen writes us as follows: "Phryganeid cases like those sent, are described by me in the Stettin Entomologische Zeitung, 1864, p. 130, as *Helicopsyche glabra* Hagen, from a specimen received from the collections of Prof. Dunker, labelled *Valvata arenifera* Lea, North America. The *Valvata arenifera* Lea, from Tennessee, Cumberland River, near Nashville, seems different, and my specimens described (Zeitung, p. 129, No. 8) from Mexico, are perhaps identical.

"*H. glabra* is mentioned in a "Note on Certain Insect larva-sacks, described as species of *Valvata*" (from Troy, N. Y.) by Mr. Th. Bland, Lyc. Nat. Hist., New York, Vol. 8, p. 144, and the case and the parts of the broken imago were identified by me and described in the Entomologist's Monthly Magazine, Vol. II, p. 252, and Stettin Entomologische Zeitung, 1866, p. 244. The cases are identical with my *Helicopsyche glabra*, and the imago with my *Notidobia borealis*, Synopsis of North American Neuroptera, Vol. 1, p. 271. It has also been received from Canada.

"I have seen the pupa skins, but never the larva, neither the operculum of the case. The description of the larva would be very interesting. Perhaps you will find an *asymmetrical* animal, to judge from its manner of living in a trochiform sack. I think this would be the first asymmetrical larva among the hexapodous insects.

"Among the described American Phryganeidæ, I have no doubt that *Notidobia lutea* Hagen, pertains to *Helicopsyche*. Brauer has described (Voyage of the Novara, Neuroptera, Vol. 1, p. 26–30) and figured the larva and pupa of *Helicopsyche Ceylonica*, and says nothing about an asymmetrical position, but not having seen the living specimens, perhaps it was overlooked. Prof. Von Siebold long since wrote to me that he supposed that an asymmetrical posture would be observed in the living larva.

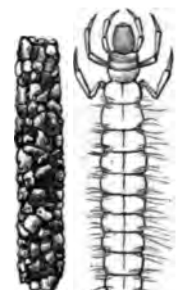
"In the Stettin Entomologische Zeitung, 1865, p. 205, I have given a list of the described American molluscan species, pertaining to the *Helicop-*

syches. I remarked that Frauenfeld (Wiener Zoologisch-Botanischen Gesellschaft, 1864, p. 623) proves that *Paludina lustrica* Say, is a mollusk, and not a Helicopsyche, as supposed by me from a specimen in the collection of the celebrated conchologist, Prof. Dunker."

Fig. 33.

We also figure (Fig. 33) an interesting form found near Portland, Maine, by Rev. E. C. Bolles. The larva builds a thin long conical sandy tube, supported between two "needles" of the pine. We do not know the adult form. Fig. 34 (larva and case) represents a very abundant Case-worm, which we have found in great abundance in Labrador. Though we do not know the imago, we suppose it is the *Limnophilus subpunctulatus* Zetterstedt, a very abundant species in the arctic regions.

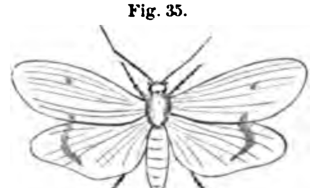
Fig. 34.



a

The imago of the Caddis-fly has a rounded body, with moderately broad, parallel veined wings, which are folded on the sides of the body, and the head is provided with long antennæ and palpi. The smaller species are often hardly distinguishable from many small moths. The females lay their eggs in gelatinous masses on aquatic plants, above or beneath the surface of the water. The larvæ are found abundantly in the bottom of ponds, in cylindrical cases of grass or stems of reeds, or bits of sticks, sand, minute shells, etc. They assume different forms, sometimes a long, conical shape, or imitating snail shells. The larva lines the interior with silk, and by bristles on the side of the body and a pair of anal hooks keeps its body adhering to the sides of the case while it drags it over the bottom. They eat large quantities of minute water fleas (entomostraca) and small insects, while many are herbivorous, the larger ones eating whole leaves that have been submerged, while the smaller ones leave the veins entire. When about to change to pupæ, the larvæ close up the mouth of the case with a net-work like a grate for the passage of the water for respiration. When about to leave the pupa state they crawl up stems of plants, or the smaller species use their light cases as rafts to rest upon as their wings are drying.

Fig. 35.



Neuronia semifasciata (Fig. 35) is our largest species, and is taken away from damp places; but the smaller species are only taken on leaves of bushes and herbage by streams and ponds. They run swiftly, but fly with some difficulty. The species are numerous. We should be greatly obliged for living specimens of the *Helicopsyche*. — A. S. P.

GEOLOGY.

THE PLAINS OF KANSAS.—Six companies of the 10th U. S. cavalry marched from Fort Riley, Kansas, on the 15th of April, 1868, under orders to encamp for the summer near Fort Wallace. The route is along the line of the Union Pacific Railroad, eastern division, which is now completed to within thirty miles of Fort Wallace. This is known as the Smoky Hill route.

It is very generally believed that the plains are level prairies like those of Illinois; but this is not so. By the plains, frontiersmen mean the country west of the settlements, to the base of the Rocky Mountains. Along the line of the Smoky Hill River, the country is rolling and constantly broken by ravines. My notes commence at Fort Harker. This post is situated on the Smoky Hill, eighty-five miles west of its junction with the Republican, and two hundred miles from the Missouri River.

The soil in the river valley is deep and rich, as is also that of the numerous creeks flowing into it. The bluffs are mostly unsuited for cultivation, being formed of gravel and clay, covered with a soil but a few inches thick. The buffalo grass, with which the high ground is covered, does not grow more than three or four inches high, but is very sweet and nutritious, and is preferred by animals to the longer grasses found in the river bottoms. It is said by those who have been on the plains for many years, that as the buffalo is driven westward, the buffalo grass is replaced by others of more vigorous growth, especially by the blue-joint grass, which reaches a height of two or three feet. I was led to believe this true by personal observation, and it is probable that as the ground becomes covered and shaded by grasses of more luxuriant growth, and as forest trees obtain a more extensive foothold, the climate will be benefited, and there will be a more equitable fall of rain throughout the year. Very little rain falls from July to March, and a large proportion of that is carried off within a few hours by the numerous creeks, which are dry at other times in the dry season.

Timber is only found on the plains along creeks and in ravines, where it is protected from prairie fires by the abrupt banks which are bare of grass in consequence of the constant falling away of the earth along their steep sides. The principal varieties of timber about Fort Harker are cotton-wood, oak, elm, ash, black-walnut, hackberry, box-alder, coffee-bean and willow. Timber becomes more scarce as you go westward, until approaching the mountains, where it becomes quite abundant, pine and cedar taking the place of oak and other hard wood.

One of the earliest flowers is the Prairie-pea (*Astragalus Mexicanus*). The fruit is about the size of a green gage plum, and is very abundant, the fleshy pod being the part eaten. It tastes like the pod of the common pea, but when cooked is insipid and rarely eaten. A wild Hyacinth is found in the lowlands, and the Poppy-mallow (*Malva Papaver*), which a little later in the season is found in extensive beds, with its purple blossoms and dark green leaves, forms one of the most brilliant figures in the

prairie carpet. The blue flowers of the Spiderwort are scattered over the bluffs, and a variety of Sida, with rose white flowers, form bright patches on the buffalo wallows. Along the steep banks of the creeks and ravines, the sensitive Brier (*Schrankia*) is to be found, not blossoming, however, till late in May. The blossom is unique and beautiful. It is a round composite head; the numerous long purple filaments make of it a silken tassel, the anthers tipping each thread with gold. The Prickly Poppy (*Argemone*) looks now like a common thistle, but in July it will put forth its large pure white blossoms.

The rock about Fort Harker is a sandstone of the Cretaceous period. It varies from a soft white stone, that may be broken up into sand by the hand, to a hard dark red stone, according to the amount of oxide of iron it contains. Where it has the right proportion of iron it is easily worked and makes an excellent building stone. The quarters at Fort Harker are built of it. While the quarry was being worked a large number of impressions of leaves of trees of existing species were found, the willow and oak most abundantly. Near the mouth of Wilson's Creek, twenty-two miles west of Harker, is a bed of lignite, which is being worked by a joint stock company. I was not able to visit it, but saw some specimens of the coal, and doubted if the sanguine expectations of the stockholders would be realized. At Fossil Creek, fifteen miles from Wilson's Creek, there is exposed a stratum of limestone, filled with a large fossil conchifer unknown to me. At Big Creek, near Fort Hays, we found antelope and buffalo abundant, and several buffalo calves have been caught and are being raised on cow's milk. They soon become quite tame.

I have had a serenade every morning and evening from a mocking-bird which has located himself in a large elm tree in the rear of my tent, the only mocking-bird I have heard in this State. There are beaver dams all along the creek, and numerous trees, recently cut down by sharp teeth, show that they are still plentiful.

A variety of wild mustard found here in damp places, makes excellent grass. In addition to those found at Fort Harker, there are a variety of Anemone with white and blue flowers, and a delicate pink Verbena. A variety of Penstemon (*P. grandiflora* and *P. Digitalis*) are found at Fort Harker later; and two varieties of Allium, the flowers of one, if crushed, giving out a delightful fragrance, while the stem, if crushed, emits a strong odor of garlic; and also *Castilleja sessiliflora*, *Ellisia Nyctelæa*, and a great variety of plants belonging to the order Leguminosæ. The rock about Hays is a soft chalky marl, unfossiliferous as far as I could learn.

On the 25th of May we resumed our march westward, on the second day passing through a swarm of grasshoppers, extending about two miles. These plains are, doubtless, the breeding places for the immense swarms, which at times devastate portions of the State farther east. We encamped the 29th near Castle Rock, forty-nine miles west of Hays. This rock at a little distance looks like an immense old castle in ruins. It is ninety-one feet high, and about three hundred in circumference. It is composed of a bluish, friable, argillaceous shale about one third of the

way up, and above this of a light yellow compact marl. It was evidently, at one time, continuous with some bluffs of the same character a mile south of it. The 30th we encamped at Monument Station, which receives its name from a number of columns of the same character as Castle Rock. There is a company of Infantry stationed here under command of Brevet. Lt. Col. Cunningham. As I rode up in front of Col. Cunningham's quarters, the first thing that met my eye was a pile of fossil vertebræ, and the jaw of an immense Saurian. The jaw is over three feet long and is well preserved. The Colonel has already dug out sixty vertebræ. He estimates the length of the reptile at thirty feet. He was lying in a stratum of brick-red clay, below which is the shale and above the marl, which is described as forming Castle Rock. By hunting in the same locality I succeeded in finding a large number of shark's teeth, and the tooth of a Saurian. On the day following I found a place where the shale I have spoken of was uncovered, and on its surface picked up a quantity of fishes vertebræ, and some teeth. I found also the jaw of some small reptile, and just as I was returning, stumbled upon a pile containing about two bushels of fragments of fossil bone. The bones were badly broken up, but still sufficiently preserved to show that some unfortunate Saurian had been buried there. Between this place and Fort Wallace I obtained numerous specimens of fishes' vertebræ, and three vertebræ of a smaller Saurian. I am informed by Ass't Surgeon Turner, U. S. N., that he has forwarded to the Museum of the Academy of Natural Sciences, at Philadelphia, a very perfect specimen of a Saurian, which he estimates to have been fifty feet long. It was found in the blue shale of which I have spoken. Fort Wallace is situated near the extreme western boundary of Kansas, within two or three miles of the Colorado line. The post is built of a light yellow marl, which may be readily sawed into blocks with a common hand-saw. A variety of Spanish Dagger (*Yucca*) is very abundant here, and is now in bloom, as is also the Mammillaria macromeris, which has a beautiful rose colored blossom, and the prickly-pear is beginning to put forth its large yellow blossoms.

We have in camp three young antelopes caught upon the march. They have become quite tame. The black-tailed deer is found in this vicinity, which is about as far east as it ranges. I have slighted the centipedes and the rattlesnakes, but it is not because they are scarce. One of the officers shook a large centipede from his boot the other morning, and nearly every one can produce a handful of rattles as proof that rattlesnakes are becoming scarce.—DR. G. M. STERNBERG, U. S. A.

MICROSCOPY.

A NEW PROCESS OF PREPARING SPECIMENS OF FILAMENTOUS ALGÆ FOR THE MICROSCOPE.—The working microscopist well knows how little really valuable information, of a practical character, is to be found in books professing to treat of the subject of preparing and mounting specimens of the lower families of Algæ, so as to exhibit in a satisfactory

manner the characters which distinguish them in a generic or specific manner. This remark also applies, although with not so much force, to other branches of microscopic manipulation, as there are really many valuable hints to be found in the books descriptive of preparing woods, bones and other hard tissues, and the subject of injecting has received much attention, so that the labors of the student are very materially lightened by the perusal of the works of the German, English and French manipulators. But in microscopic botany our information is woefully deficient and old. The microscopist is therefore driven to the necessity of experimenting, and, as a consequence, discovering for himself. As the students of the lower families of plants are at the present time somewhat numerous, the result has, of course, been the development of many extremely valuable processes tending to simplify their study; but it is to be regretted that, whether from extreme modesty, or perhaps from some other cause, such as the fear that their processes are not new, or would not be appreciated, these gentlemen have, unfortunately, failed to publish. It cannot be denied that this mode of action is wrong, and that no one has a right to withhold the knowledge he may possess on such points. For my part I have taken every opportunity of publishing, or otherwise making known, any little point in manipulative microscopy which I have found of value, and which I have thought would in any way be of use to others.

For years I have been engaged in the study of the lower families of Algæ, more especially the Diatomaceæ, and for the purpose of eliminating their characters, I have at different times experimented upon the preparation and preservation of these beautiful forms, so as to be enabled at any future time to exhibit them in the best manner for showing their peculiarities. I have already published processes for obtaining the siliceous loricæ of Diatomaceæ from guano, and also several modes of collecting, preparing and mounting for the microscope these organisms. It is now my intention to make known a process I have contrived by means of which the filamentous forms of Diatomaceæ, Desmidiæ and Confervæ, can be preserved and mounted so as to show many of their characters, although, as is always the case, something has to be sacrificed. However, it is in my opinion the best process that has been as yet made public, and even if it is of no other value, I trust it will have the effect of drawing from others records of their modes of manipulation, so that searchers after truth, like myself, may learn something of value to them in their investigations.

It is well known that the Desmidiæ and the filamentous Algæ, generally found growing in fresh water, have never been preserved in a satisfactory manner, and this has arisen from the fact that their cell-walls are composed of a substance of a perishable matter, and will not, like that of the Diatomaceæ, which is siliceous, bear boiling in corrosive liquids so as to remove the always readily decomposable cell-contents, and leave the object clean and transparent, while the Diatomaceæ, after such treatment as boiling in acid can be mounted in Canada balsam, by means of which

they are presented in such a state that the finest sculpture of their siliceous epidermis can be observed, and they are at the same time held within a preservative substance which does not permit of their movement and consequent danger of fracture; the Desmidiæ and the filamentous Algæ in general cannot be preserved so, and several means have been devised to keep them, all of which have been to a certain extent unsatisfactory. Besides there are some Diatomaceæ which grow in chains, as the Fragillaria, the frustules of which are united by means of a substance that will not bear the contact of acid necessary to remove the cell-contents; and again there are others, as the Gomphonema, which are attached to submerged substances by means of a flexible stalk called a stipe, which would dissolve under the same circumstances. Such Diatomaceæ have been generally merely placed in a cell formed of cement or other suitable substance, and preserved in a preservative solution consisting either of pure distilled water, or water containing creosote, camphor, or other substance possessing antiseptic properties. And the same plan has been followed with the filamentous Desmidiæ and other Algæ, but such specimens become, after a short time, unsightly. It is true that the general outline is preserved, but the cell-contents either contract or change in form and color, so as to injure the appearance of the specimen, or the same effect is brought about by the colored matter generally accompanying gatherings of such organisms.

My plan then is essentially as follows: Supposing I have a gathering consisting for the most part of a filamentous Desmid, as *Desmidium Swartzii*, which is a common species around New York city at certain periods of the year, I place a small quantity of it in a test tube, and pour over it, so as to about quarter fill the tube, a strong solution of the so called "chloride of soda," which I prepare for the purpose in the following manner. Those, however, who have not the facilities for doing so, or do not desire to prepare their own solution, can use that sold by the apothecaries under the name of "Labarraque's Solution of Chloride of Soda," which is, however, rather weaker than it is best often to use. My solution I make by adding to the water a large excess of the common chloride of lime of the shops, which is fresh and has not stood for a time in an open vessel exposed to the air, by means of which much of it becomes decomposed and useless for this purpose. After stirring well, and then allowing such a mixture to stand for a short time, until all that will not dissolve falls to the bottom, I pour off the clear liquid and add to it a concentrated solution of carbonate of soda, the common "washing soda," until the white precipitate of carbonate of lime, or chalk, ceases to form. The clear solution is now poured off preferably through a good paper filter, and preserved in a well-corked bottle, away from the light. This is my solution of chloride of soda. The Alga is now boiled for a few minutes in the solution, but not so violently or for such a length of time as to break up the filaments, and then well and thoroughly washed with pure filtered or distilled water. It can thereafter be preserved in weak spirits, or, what I have found still better, water to which a few

drops of creosote have been added. Thus the growth of fungi is prevented, which would otherwise mar the appearance of the object very materially.

To mount such bleached specimens, I proceed as follows. Those which have been set aside in creosote water may be, of course, put up permanently in that liquid, but those which have been preserved in spirits, I prefer to mount in creosote. A cell is procured of any suitable substance, as black varnish, gold size, marine glue, or other cement which will withstand the action of water, and a fragment of the Alga being placed in it in the usual manner, water is added, and a fine glass rod or stick of wood just moistened with creosote brought in contact with the liquid. In this way the water becomes sufficiently impregnated with the preservative to insure its antiseptic action. The cover is then put on and cemented down. Thus we have a specimen of the Alga in a transparent condition, all colors which interferes with the observation of many points of structure being removed. In place of creosote water I have made use of camphor water, and found it to answer admirably. The camphor water I make by using distilled water, and just before placing on the cover, putting in a grain of gum camphor, which then remains in the cell, and if near the edge does not mar the appearance of the object in any way. Specimens can also be mounted in the glycerine-jelly of Mr. Lawrence, which preservative I find to be excellent for all kinds of Algæ and vegetable preparations generally; in fact after a little practice, the manipulation of it becomes almost as easy as that of balsam, and air bubbles, those torments of beginners, are the exception and not (as is the case for a long time generally after a tyro begins mounting microscopic objects) the rule. Of the use of this jelly, or rather a modification of it, I shall at some future time have more to say.—ARTHUR MEAD EDWARDS, *New York.*

ANSWERS TO CORRESPONDENTS.

J. T., Tabor, Iowa.—The Land and Fresh-water Shells of the United States, by Binney, Prime and Tryon, published by the Smithsonian Institution, will be the most modern works for reference. Descriptions of Unios, etc., are mostly contained in the writings of Isaac Lea, of Philadelphia. The best way to procure specimens for your college, is to make good collections of your native animals and plants, and then exchange them with other parties. We will announce such desires to exchange free of cost.

E. G., Albion, Wis.—Your specimens considered as *Ophioglossum reticulatum* Fries., does not seem to differ from dwarf and depauperate specimens of *O. vulgatum*, nor do the reticulations differ in any way that I can perceive, on comparison with British or with New England forms. Never having seen either a description or authentic specimens, such as you say were collected by Prof. Kumlein, I have no means of speaking with any certainty. The same style of reticulation occurs in *O. bulbosum* Michaux, a Southern variety; and as the species is very variable, it is probable that *O. reticulatum* is but a local variety, though the botanical authority of Fries is of great moment regarding any plant which comes under his observation.—J. L. R.

B. F. L., Concordville, Pa.—To your query, "How long will spiders live without eating?" we would reply that adult spiders, like adult six-footed insects, will fast for months, though when young and growing they are usually voracious. How your young spiders lived twenty days after hatching without food, we do not understand, though we have observed that the young of the Moose tick lived nearly a month without food after hatching.

The Tarantula is confined to the Southern States, though the Editors of the "American Entomologist" report the occurrence of *Mygale Hentzii* in Missouri. It may possibly occur in Eastern Indiana. Spiders are well known to be cannibals, the females

after their love passages with their partners, frequently falling upon them and devouring them. The "Guide to the Study of Insects" will contain chapters on the *Arachnida* and *Myriapods*, with numerous illustrations.

C. E. R., Roxbury.—The field lies before you at low tide. The best books you can have are those exposed to you by nature. It will be impossible for you to study all until you have mastered some of the leading principles of zoölogy. And the best way to commence is to select some group, among the mollusca for example; collect all the species you can, study them, ascertain all you can regarding their habits. Work patiently from year to year; be sure you have a love for it at every step. If you choose the mollusca, Gould's Invertebrata is the best and only guide, a new edition of which will be out soon, in connection with Woodward's Manual of the Mollusca. 12mo, London. Should you study the radiates, Agassiz's Seaside Studies, published by Ticknor & Fields, is the best for reference. As for the crustacea and worms, their descriptions are scattered through many publications, especially the Journal, Proceedings and Memoirs of the Boston Society of Natural History.

H. G., Detroit, Mich.—The specimens boring the hickory were *Clytus pictus* in the larva, pupa and beetle stage; the other larva also found in the hickory log, seems to be the larva of one of the *Cleridæ*. We should be greatly obliged for any specimens of Coleopterous larvæ for the Museum of the Academy, which already has a good collection of the early stages of insects. Will not all our friends, who perhaps do not usually preserve larvæ in their entomological expeditions, send them to us, especially the larvæ of *Carabidæ*, and those injurious to fruit and forest trees. If possible, put the larvæ, pupæ and beetle together in a vial, with whiskey. Will our Southern friends, as the season opens, remember that we want specimens of the Cotton Ball Worm and Army Worm, in all their stages, including the Moths, which can be sent in folded papers, by mail, though better in stout chip or pasteboard boxes.

R. S., Waverly, N. Y.—In order to reply to your question as to the locality where the stone used by the Indians for making arrowheads was obtained, it will first be necessary to know the exact species of mineral your arrowheads are made of, as several minerals were in common use for the purpose, and many arrowheads, knives, etc., were undoubtedly made from minerals only existing in localities far distant from the spot where the manufactured articles were found. The hornstone (a mottled drab-colored stone), which was in very common use for arrowheads, etc., has generally been supposed to have been taken from Mt. Kineo, on Moosehead Lake, in Maine, but that it also occurs in other places, is evident from the fact that Prof. Wyman has in his cabinet a stone which he picked up at a gravel bank in Cambridge, identical with the mineral from Mt. Kineo. Several characteristic varieties of jasper occur in Lynn and Saugus, and were much used for arrowheads, etc. Dr. True has a short paper in the Proceedings of the Portland Society of Natural History, Vol. I, p. 165, on this subject, but sufficient attention has not yet been given to this very interesting subject to enable one to trace the source of all the minerals used. We are receiving specimens of arrowheads, knives, axes, gouges, pottery, etc., etc., from various parts of the country, and hope in time to add our mite to the general stock of information on this subject. We should be pleased to receive any specimens you could obtain for us from your own or other localities, to add to the Academy's collection.

W. E. E., Dorchester, Mass.—The shells from a spring are *Pisidium variabile*.

SCIENCE GOSSIP.—Our subscribers (before February 15th) should have received their copies of Science Gossip by this time. If not received please inform us, as we have notice from the Editor that they have been mailed. We receive subscriptions for the "Gossip" at any date, and can secure back numbers.

A. S. J., Iowa City.—Lectures on Comparative Anatomy and Physiology of Vertebrate Animals. Part I. FISHES. By Richard Owen. London, 1846. Longman, Brown, Green & Longman.

J. H. B., Richmond, Va.—Lippencott & Co., of Philadelphia, have published an illustrated work on the Birds of North America, by Baird, Cassin & Lawrence. 2 vols., 4to, with one hundred colored plates. Price $22.50. Atlas sold separate for $17. Prof. Baird's Report on the Birds of North America (ninth volume of the Pacific Railroad Surveys) is now the standard work on American Ornithology. We can furnish copies of either works.—Cooke's Fern Book, $1.00.

SEVERAL CORRESPONDENTS have asked questions regarding the use of Carbolic acid as a substitute for alcohol, etc., to which we answer that Carbolic acid in water alone will not preserve animals, but pure Glycerine, with a very small amount of Carbolic acid (say about three or four drops of acid to 2 oz. of Glycerine) answers admirably for some delicate animals. But the best thing for preserving most animals is alcohol. The contraction of animals put into alcohol (complained of by some correspondents) is caused by the alcohol being too strong. All animals should be put into weak alcohol at first (not over twenty-five or thirty per cent.), and after remaining a few hours should be transferred to about seventy-five or eighty per cent. alcohol. A very fine article for preserving the tissues of animals, and for soft animals like mollusks, actinias, worms, insect larvæ, etc., can be made after a few experiments, of Glycerine, a little of the strongest alcohol, and a very small portion of Carbolic acid. This preparation will preserve the colors as well as the tissues. A little fine soap (white castile is the best) put into alcohol will prevent most colors from fading, unless exposed to direct sunlight.

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BITTERNS.

BY WILLIAM E. ENDICOTT.

Many persons are repelled by scientific nomenclature. Let not such, however, turn away from this article when I say that the name of the genus I write of is *Botaurus*, for the English term "bittern" is the same word, only in a dif-

Fig. 36.*

ferent shape, and comes from the Latin *Botaurus* (*i. e.*, *boatus taurinus*), through the French *butor*, or Spanish *bitor*. *Botaurus*, *butor*, *bitor* or *bittern*, it is all one, and means "bull-voiced." The popular local names the bird has re-

* *Botaurus lentiginosus* Stephens; from Tenney's Zoölogy.

ceived are nearly all from the same characteristic: these are Stake-driver, applied to our own bird, and Mire-drum, Bull of the Bog, Butter-bump and Bog-blutter (*i. e.*, bleater), applied to the European species.

Australia is a land of anomalies; a kingfisher lives there which avoids the water, dwells in arid wastes, living on lizards and snakes, and has his home in a tree; and possibly some unknown species of bittern may belong there which flutters about the upland fields and lives on seeds, and will be held in high repute as a warbler when he shall, hereafter, be found, and will be kept in a gilded cage with a cuttle-fish bone. That would indeed be a sight worth going half-way around the world to see. I dare prophesy, however, that that island's vast unknown interior will produce no such wonder, but that all unknown bitterns will be found to agree in character with the known. What that character is, how it differs from our supposed songster, let us now consider.

The prophets use its name in foretelling desolation. Says Isaiah, of Babylon, "I will make it a possession for the bittern;" and Zephaniah says of Ninevah, "The cormorant and the bittern shall lodge in the upper lintels of it." Hear also what Mudie, who was not a prophet, says of the European species. "It hears not the whistle of the ploughman nor the sound of the mattock: and the tinkle of the sheep bell or the lowing of the ox (although the latter bears so much resemblance to its hollow and dismal voice that it has given foundation for the name) is a signal for it to be gone. Places which scatter blight and mildew over every herb more delicate than a sedge; which are the pasture of those loathsome things which wriggle in the ooze, or crawl and swim in the putrid and mantling waters; places which shed murrain over the quadrupeds, or chills which eat the flesh off their bones; places from which even the raven, lover of disease and fattener upon all that expires miserably and exhausted, keeps aloof (for 'the reek o' the rotten fen' is loathsome even to him), are the chosen habitation, the only loved home of the

bittern. He is a bird of the confines, beyond which we can imagine nothing but utter ruin."

This picture is, I think, somewhat overdrawn; moreover, no naturalist ought to speak of the waste places of Nature in that disapproving way. We might pardon a mere collector for writing so of bogs and wilds, he knows no better; to him, a natural history store, where he may *buy* his eggs, his shells, his bird-skins, or his sea-mosses, is preferable to the swamps he must struggle through, the thickets he must thread, the plains he must traverse, and the sandy or muddy sea-beaches he must frequent if he would be a *student* of Nature. Dry feet, untired limbs, clothes and flesh untorn by briar and bramble, are not for the naturalist at all hours, nor should he complain; a new plant, a rare mollusk, a bird till now unseen, an egg till now unknown, repay such trials as these; and, if he find no such prize, his tramp, like virtue, is its own reward. That there is something about the fowl, of which Mudie thus speaks, that appeals strongly to the imagination is not to be denied; but the bird is, nevertheless, a reputable bird, although he is the one which ignorant peasants in the old countries know by the name of "night raven," believing that disaster or death must needs follow when they have heard his voice booming over the fens on a warm cloudy night, as they staggered their drunken way home from the ale-house. Terrible as the voice sounds to their dull senses, it is sweetest music to the bittern's mate, sitting among the grasses below him, or with him circling the sky just under the cloud.

On this side of the Atlantic we have no superstitious fear of the fowl, and do not think the swamps accursed by his presence. He is a lovely bird in unprejudiced, discriminating eyes; he has no gaudy colors, but his blacks, his browns and yellows, of many shades, all of them pleasing, are so blended as to produce a beautiful, harmonious effect. He loves waste places, for they furnish him safety and food; safety, because his enemy, man, is fond of a dry foot; and

food, for frogs and snails and snakes and mice, all prime delicacies with our hermit, abound there, and, with an occasional minnow, supply all his wants. And yet his safety is not perfect, for the prying naturalist, for whom mud and water have no terrors, sometimes comes across his home and family; and the wanton gunner, starting him up from his fishing and frogging, never spares him, but shoots him at sight; and what man, with an arm and a leg broken and body pierced with a dozen bullets will make as good a fight as does our bird when the destroyer goes to pick him up? As long as life is in his wrangled body, he never ceases to lunge and thrust at his murderer's eyes with his spear-like bill, scorning to yield to either pain or fear.

He comes to us from Mexico, Central America, and the West Indies (the European species winters in Africa) early in the spring (I bought one, freshly killed, in the latter part of March, 1868, though that was very early indeed), and probably takes up his abode in the same swamp which last year he frequented. The "tinkle of the sheep bell" does not banish the bold bird; he and his mate live in their five or ten acres the whole summer through, although just outside their bushy quagmire the white-shirted haymakers may whet their scythes and shout to their horses, and the locomotive with his thundering train may go tearing by almost every hour in the day. It seems that the raven avoids the bittern's domains, because he don't like the "reek o' the rotten fen." Very well, let him stay away if he likes, the beautiful yellow-throats and swamp-sparrows, and, if there is a rotten stump, the chickadees, make his place good and more than good. With their company and with surroundings of purple-blossomed Kalmia, glossy-leaved Smilax and pink Calopogon, quiet cedars, nodding sedges, and rustling grasses, Old Sooty's absence will be little mourned.

Some speak of finding the bittern breeding in colonies in trees. Good observers say so, and I believe them; but I think that all such cases are owing to accidental circum-

stances, such as the inundation of their marshes. Certain it is that I have never found them so associated. "Le butor," says M. Holandre, "est très sauvage, farouche, solitaire." One tiger's den to a jungle, one eyry to a mountain, and one pair of bitterns to a bog seems to be the rule.

In the place where I have found them, there is retired feeding ground for a thousand, dense cedar swamps extensive enough for as many nests if they only chose to congregate, like their social cousins, the herons; and yet two by two they live, their next neighbors nobody knows how far away,—not in the same swamp at any rate; and on the ground, the bare ground, they lay their four or five eggs, among low laurel, tufts of grass, or, as in the case of the first nest I ever found, at the foot of a swamp huckleberry (from which the four callow young, unable yet to stand, tried to drive me away by repeated tumbling charges, menacing me by clumping their soft mandibles, and by sending angry hisses from their wide-yawning, yellow throats).

I have been surprised to find the general uncertainty which pervades ornithological works, upon the subject of the color of the bittern's eggs. These really are of a dark drab color in the case of our own bird as well as of the European; in fact I could find no distinguishing marks between these two species when examining a large number of both, which I was enabled to do by the kindness of Mr. Samuels. I have not been able to find any variation in the color of those of our species, though I have inspected eggs from all parts of the Union. Hear now what a few of the authorities say: Audubon declares that he never found the bittern's nest, nor, apparently, did he ever see its eggs, for he says nothing of them. Nuttall writes, "the bittern *is said* to lay cinereous green eggs." Wilson, "they breed at Hudson's Bay in swamps, and lay four cinereous green eggs, *we are informed.*" Richardson, "they lay, *according to Mr. Hutchins*, four eggs of a cinereous green color." Latham, "breeds at Hudson's Bay, and lays four cinereous

green eggs." Peabody, "eggs of a green color." Thompson, "six eggs, of a dark, bluish-brown, clay color." Finding the venerated authorities determined that the eggs should have green on them of some shade or other, I made a fresh examination, thinking I might have been mistaken. I studied them long and carefully in every light, and gave them full consideration, but it was all in vain. I did once think I had detected a glancing greenish reflection, but found the color came from a window blind. I have stated that the eggs of the American and the European species are just alike. Let us see what European authors say: Selby says, pale green; Bewick, greenish white; Fleming, olive green; a writer for the London Tract Society, pale greenish-ash; Mudie, greenish brown; Albin, whitish, inclining to ashy or green; Latham, pale ash-green; Goodrich, pale green; M. Holandre, *blanc-verdâtre*; Nauman and Buhle give a figure much too dark. It is hard to be obliged to say of so many well known men that their statements are unreliable; but seeing is believing, and the truth is the truth, and the color is as I have said. Mr. Samuels gives the true state of the case with regard to our bird, and Yarrell in regard to the European species, and Hewitson and Atkinson, the former of whom borrowed the specimen he figures from Mr. Yarrell, both give accurately colored plates. When writers will say such things of the European kind, we need not be surprised, however incredulous, when Latham tells us that a Cayenne species lays "round whitish eggs, spotted with green." Besides all these errors, the author of the article "Bittern," in the "New American Cyclopædia," says that the bird "builds in trees, like the herons, ordinarily rearing two young," a statement about as incorrect as it could be. Mudie speaks as follows of the European bittern's voice: "Anon a burst of savage laughter breaks upon you, gratingly loud, and so unwonted and odd that it sounds as if the voices of a bull and a horse were combined; the former breaking down his bellow to suit the neigh of the latter in mocking you from

the sky." "When the bittern booms and bleats overhead one certainly feels as if the earth were shaking." Goldsmith's description of the bittern's voice is one of his most pleasing passages. Many of the poets speak of the bird's strange voice, and even in the time of Thompson (Thompson of the Seasons) it was thought that the bill was thrust into the mud in making it. Chaucer speaks as follows in The Wife of Bath's Tale:

> "And as a bitore bumbleth in the mire,
> She laid hire mouth into the water doun,
> Bewray me not, thou water, with thy soun',
> Quod she, 'to the I tell it, and no mo
> Min husbond hath long asses eres two.'"

Another notion was that the bill was put inside a reed to increase the sound; the truth is, of course, that the bird uses no means to produce its bellow but its own organs of voice. Our own bittern has no such roar, but, as its name in most parts of the country denotes, makes a noise very much like driving a stake with an axe. It has also a hollow croak at the moment of alarm.

These remarks apply to the American and European species; the geographical range of the former is from latitude 60° north, to Central America and the West Indies, having never been found, I believe, south of latitude 10° north. It is of rare occurrence west of the Rocky Mountains, though not uncommon in other parts of the United States. Many specimens of this bird have been shot in the British Isles, particularly in Ireland. The first recorded capture was in Devonshire, England, in October, 1804; the prize was by some regarded as a new species. All such specimens have been killed in the fall, so that there can be no doubt that they were blown out to sea in their autumnal migration.

The European species has a wider range. Selby says it is confined to Europe, but such is not the case; it occurs, though rarely, in Norway, Russia and Siberia, up to latitude 65° north, and is found breeding at the Cape of Good Hope, in latitude 35° south. In the other direction it extends from

the Atlantic to the River Lena, in Siberia, and is found, though sparingly, in Hindostan. It is very rare in the British Islands, owing, probably, to drainage of bogs; so rare in fact, that some naturalists have thought it worth their while to give date and place of the killing of all specimens they have seen. In England it is said to breed only in Lincolnshire, Cambridgeshire and Norfolk. In old times the bittern was held in high esteem for the sport it afforded when pursued by trained falcons. Both birds would mount in spirals, oftentimes out of sight; the bittern straining every nerve to keep above the hawk, the hawk doing his best to rise above the bittern so as to make the fatal pounce. The bittern, being of weaker flight, rarely escaped, but often in his death involved his enemy's; for as the cruel falcon came down with rushing wings, exulting in his fierce soul, the bittern, in his dire extremity, thrusting up his sharp beak, empaled the triumphant savage, and both came tumbling from the clouds together, striking the earth with a thump which drove the last breath from both. A lesson to tyrants not to push the weak to despair.

On account of its furnishing such excellent sport to the humane of former times, rigorous laws for its protection were passed in the reign of Henry VIII, and of Edward VI, which imposed a fine of eight pence and a year's imprisonment for every egg taken or destroyed. There was something like protection. The long hind claw was a most excellent toothpick, for, besides its functions as such, it had, if the wisdom of our ancestors was infallible, the highly meritorious property of preserving the teeth from decay. It appears, moreover, that the fowl had then the power of displaying a brilliant light from the centre of its breast, which attracted fish to it in great shoals, so that the satisfying of its hunger took but a small part of the night, and much time was left for other pursuits, one of the most cheerful of which was to soar above the hovel of the British ploughman or hedger or ditcher, and rouse him from his lethargic sleep

or struggling nightmare with a doleful noise, portending certain death to Hodge, or Joan, or some one else; and this prediction was always fulfilled to the letter, for in the course of the next twelve months some one was sure to die in that county or the next. The flesh of the prophet, however, was very good, provided his skin was stripped off before cooking, that it might not impart a muddy odor and taste.

Thus it will be seen that our bird was a strange compound of good and evil, besides having some magical properties which weighed on neither side; but the march of centuries, which has changed everything for good or ill has had its effect upon the bittern. He can no longer preserve our teeth, nor can he cast a murrain upon our cattle, nor even foretell somebody's death; even his magical light is gone, and he is now a quiet obscure fellow, doing man neither good nor ill, and asking only to be let alone. As to the bitterns of less civilized countries, their manners and customs have never been described at much length, but they appear not to differ much from the American and European species, except that the lineated bittern of Cayenne is said by Latham to be capable of domestication, and to be then an excellent mouser.

The bitterns are all much mottled in plumage, and may be divided by this mottling into three groups, viz.: First, The Rayed Bitterns, in which the mottling takes the form of longitudinal streaks, especially on the breast, in which group are the *Botaurus stellaris* (*i. e.*, the starry) of Europe and Africa; *B. lentiginosus* (*i. e.*, the freckled) of North America, and *B. pœciloptila* (variegated feather) of Australia; this last is now thought to be identical with *B. Australis*. Second, the Spotted Bitterns, such as *Tigrisoma tigrina* (tiger-bodied, tiger-like) of Cayenne, and the Javan *B. limnophilax* (pool-guard, a name which reminds one of Hood's lines:

"The moping heron, motionless and stiff,
That on a stone, as silently and stilly,
Stands, an apparent sentinel, as if
To guard the water-lily").

Third, the Pencilled Bitterns, such as *Tigrisoma melanolopha* (black necked) of Ceylon and Burmah, and probably of the Malay peninsula; *Zebrilus undulatus* (wavy) of Guiana, and *Tig. Braziliensis*, whose name denotes its habitat. This last is the most beautiful of the family, its back being black, thickly and delicately pencilled with white and rufous; primaries, dark slate; crown, clear bright, and nape clear dark rufous. In front alone does the bird resemble our own, and even there the colors are brighter and more clearly defined.

No part of ornithological research is more fascinating than the study of feathers; the more we examine them the more we must be lost in admiration of their beauty. I have never seen more beautiful feathers than those of the American Bittern. The ones I am at present examining, though they have been plucked from the bird more than a year, retain a beautiful gloss, hardly inferior to that they wore in life. Both webs of the primaries, and the anterior one of the secondaries, have a lovely bloom of a most delicate ashy blue. There is a very regular gradation in texture, coloration, position of the shaft in the vane, and in most particulars of shape, from the first primary to the last tertial, the former being very dense, strong, of a clear unflecked slaty blue, with but one or two mere hairs of down; end acutely angled, with the shaft very near the anterior edge; the latter very loose in texture, so weak that a mere touch serves to tear its fibres apart; in color slaty brown, most finely marked with wavy lines of rusty brown, and not only very downy three-fourths of the distance to the tip, but furnished with a very soft accessory plume, three inches long and two wide: the tip widely rounded, and the shaft at the very centre. Besides these differences, there is also observable a certain indefinite youthfulness, if I may so express it, of color, which distinguishes the tertials from the secondaries; and the secondaries again have an immature, diffident appearance of texture, as compared with the primaries. No

words can express the extreme delicacy and downy softness of some of the body feathers, particularly those of the lower part of the breast, one of which now before me measures $3\frac{3}{12}$ inches in length, and $3\frac{7}{12}$ in breadth. Our species, like the European, has a black-lead colored patch on the sides of its neck, the feathers of which are very unlike common ones, being little more than shafts with parallel hairs arranged along their sides.

I have given no close descriptions of the various species, because, though such may serve to identify a bird in the hand, they seldom give any vivid idea of an unseen one in the bush. As to size I may remark that *B. Braziliensis* is the largest species, and *Zebrilus undulatus* the smallest, standing less than half as high as our bird.

There is a series of small waders found, one or more species in every country, called "small bittern," "least bittern," etc., which I leave out, because I believe they are much nearer the herons, for the following reasons: The bitterns are all thickly mottled; the herons are colored in spaces of clear color,—so are most of the "little bitterns." The characteristic color of the bitterns is brown of different shades; of the herons, different shades of ash,—as is the case with most of the "little bitterns." The bittern's feathers stand out so that the bird, particularly about the neck, looks thick and even clumsy; the heron's feathers are so arranged as to give an elegant look to the wearer of them,—so are the "little bittern's." The bittern's egg is of the color I have said; the heron's is of a clear, light green,—so is the "little bittern's." In fact the night-herons bear a much greater resemblance to the bitterns than do the small series we have been speaking of. In conclusion, I would say that I have endeavored to make this article correct throughout, but that it is very likely that it has its errors and omissions. I shall be glad to have the former corrected, and the latter supplied.

THE MULE DEER.

BY W. J. HAYS.

THE Mule Deer* (Plate 3) was first mentioned by Lewis and Clark in the report of their journey up the Missouri River. They gave it the name of Mule Deer on account of the length of its ears; the length of the ear, however, varies with individuals. I have one head which I procured on the Upper Missouri, the ears of which measure nine inches from the head, and one from the Platte with ears only seven inches in length; these measurements are from adult males. The description of Mr. Say gives ten inches. Mr. Say first described it and gave it the name of *Cervus macrotis*.

This deer is much coarser and less graceful than the *Cervus Virginianus;* its limbs are thicker and longer, although it does not vary much in weight from the largest of the common deer found in the Adirondack Mountains.

The color in summer is a dull grayish brown, and in winter a silvery gray on the body, a line of black on the back and on the breast between the fore legs; the legs are a bright brownish yellow, the upper part of the inside white. The forehead is covered with dark brown hair extending down to a line a little below the eyes. The upper lip and chin are white; there is a band of dark brown running into black, extending from the nostril to the edge of the upper lip. The black band is not so well defined on the lower jaw as in the common deer. The inside of the thighs up to the tail is white; there is also a slight indication of white under the neck. The belly is a yellowish brown, almost as bright as

* *Synonymes.*—Black-tailed or Mule Deer, Lewis and Clark. *Cervus auritus*, Warden's United States, vol. I, p. 245. Cerf Mullet, Desmarest, Mammalogie, p. 43. Jumping Deer, Umfreville, Hudson's Bay, p. 164. Great-eared Deer, Griffith's Animal Kingdom, vol. IV, p. 133. *Cervus macrotis* Say, Long's Ex., vol. II, p. 254. *Cervus macrotis*, Harlan's Fauna, p. 243. *Cervus macrotus* Sabine, Franklin's Journey, p. 667. *Cervus macrotis*, Goodman's Natural History, vol. IV, p. 133. *Cervus macrotis* Peale, Philadelphia Advocate of Science, August, 1834.

HAYS ON THE MULE DEER.

the color on the legs. The tail is seven inches in length, round, and covered with short white hair, like the tail of a pointer dog; the extreme tip, for about an inch, has black hair of about two inches in length. The tail is carried pendant, and not erect, in running.

The metatarsal gland (which in the common deer is about an inch long) is six inches in length and fringed with hair two inches in length. The ears have a line of brownish black on the edge, and are lined with long whitish hair. The horns spread wider, some measuring twenty-four inches between the tips in front, but otherwise have the general form of those of the common deer, but the points are bifurcated; and sometimes have as many as three and four branches. The hoofs are black, and not so sharp or pointed as the common deer, resembling more in form the hoofs of the Wapiti.

This description is made from specimens in my possession and from those that I have seen on the Plains, and differs somewhat from that of Prof. Baird. I am inclined to think that his description of the hoof was made from a specimen that had become dry and contracted at the base, or else of a young animal.

This deer is found from the north of New Mexico to the Saskatchewan, and from the Missouri to the Cascade Mountains. Its flesh is very fine eating, esteemed by many superior to that of the common deer.

DIMENSIONS.

	ft.	in.		in.
Total length from tip of nose to tip of tail, . . .	6	1	Length of ear, ...	9
Height at shoulder, . .	3	2	Width, "	5
" top of pelvis, .	3	6	Length of tail, . . .	7
Girth behind shoulder, .	3	4	" suborbital sinus, .	1
Girth of neck, . . .	1	10	" metatarsal gland, .	6
Length of fore leg from end of hoof to olecranon, .	2	0	" hair on metatarsal gland, ...	2
Length of hind leg from hoof to patella, ...	2	7	Length of fore hoof, . .	2½
Length of face, . . .		10	" hind hoof, . .	2¼
Width between orbits, . .		5	Greatest width of fore hoof,	1¾
			" " hind hoof, .	1¾
			Length of false hoof, . .	1

THE NATURALIST IN CALIFORNIA.

BY J. G. COOPER, M. D.

Los Angelos Plains.—In December, 1860, I found myself at Los Angelos, under orders to report at Fort Mojave, Colorado Valley, as soon as practicable. I therefore started on the fourth, in company with a train of wagons going with supplies to the Fort, mounted on a mule, and well supplied with material for collecting in that little known region.

The southern part of California, even near the coast, was still brown and barren looking from the effects of the long dry season, although some rain had fallen for a month past. There is very little tree growth except along the streams, and most of these sink in the dry season before reaching the sea, so that the nearly level plain bordering the coast for a width of twenty-five miles has a desolate appearance, though it is densely covered with herbage, and in spring puts on a garb of the most beautiful green, varied with myriads of pretty flowers. Already the lower grounds along the river bed are commencing to revive, and flocks of geese (*Anser hyperboreus* and *Bernicla Gambelii*) begin to enliven the scene; the Kill-deer (*Ægialitis vociferus*), a constant resident where water is permanent, and occasionally flocks of other waders are seen.

But the route leads away from the haunts of these semi-aquatic migrants, over the driest part of the plain towards Cajon Pass, and although animals of all kinds are less abundant there now than in the moist spots, they are more distinct from those of the Atlantic States. Ground Squirrels (*Spermophilus Beecheyi*) abound, their villages occupying every little elevation, and the squirrels themselves, which do not hibernate here, may be seen running in all directions or sitting erect near their burrows, and allowing a very near approach, confident that they can escape under ground from any

enemy. But occasionally a Squirrel Hawk (*Archibuteo ferrugineus*) is seen sitting on the ground devouring one of these audacious burrowers. The White-headed Eagle and various smaller hawks, are also on the watch for these and any other small animals they can catch, such as Gophers (*Thomomys umbrinus*), Jumping-mice (*Dipodomys agilis* and *Perognathus parvus*), Wood-mice (*Hesperomys Sonoriensis*), Hares (*Lepus Californicus* and *Audubonii*), besides such birds as fall in their way.

About the gardens are the omnipresent House Finch (*Carpodacus frontalis*), the Black Pewee (*Sayornis nigricans*), Raven and Western Crow (*Corvus carnivorus* and *caurinus*). The Western Flicker (*Colaptes Mexicanus*) was the only one of its tribe observed in this nearly woodless plain. Large flocks of Gambel's Finch (*Zonotrichia Gambelii*), and other species, flitted among the hedges, while the Golden-crowned Wren and Audubon's Warbler were the only insectivorous species that could glean a subsistance at this season among the dry willows. The Song Sparrow (*Melospiza Heermannii*) like its eastern representative enlivens the early morning with an occasional song, while the Rock Wren (*Salpinctes obsoletus*) and Cactus Wren (*Campylorhynchus brunneicapillus*) chirrup loudly from the tiled roof or dense thickets. Flocks of Quails (*Lophortyx Californicus*) become common as we get farther from the town, and the little Burrowing Owl (*Athene cunicularia*) is often seen sitting sleepily at the mouth of an old squirrel burrow. Meadow Larks and Horned Larks, as well as the little Pipit, are so numerous in places on the bare plains as to almost darken the air when they fly, and the curious Mountain Plover (*Podasocys montanus*) run in scattered flocks over the driest tracts, or wheel in swift columns around the sportsman, their white underparts sometimes shining like snow-flakes as they turn like their more aquatic cousins of the seashore.

Thus it will appear that these plains have a great variety of animals, even as seen in a hasty journey and at a bad

season, but nothing very peculiar to this part of the State occurred. Two fine specimens of the Red-tailed Black Hawk (*Buteo calurus*) would not allow of a very near approach, and the first specimen collected was a Cassin's Kingbird (*Tyrannus vociferans*), which I could scarcely believe a winter resident, although I have since found it to be so, even as far north as Santa Cruz, while its closely allied relative, the *T. verticalis*, leaves the State entirely in winter.

Approaching the mountains at Cajon Pass, extensive thickets of shrubbery, with occasional low trees, give promise of a new and more varied fauna in the spring, but at this season few animals were seen besides those mentioned. A Coyoté (*Canis latrans*) dogged our steps in hopes of some scraps to be left at camp, and at night the dismal barking howl of these animals was our constant serenade. Nests of the Wood-rat (*Neotoma Mexicana*) were common, consisting of twigs, bark, etc., piled up three or four feet high among the bushes.

Hares became so numerous that I saw more than twenty during the day while riding along the road, and a new bird appeared in pairs, or small families, running on the ground with much the appearance of Snow-birds. This was Bell's Finch (*Poospiza Bellii*), one of the more southern group. I also shot a black-tailed Gnat Catcher (*Polioptila melanura*), the most peculiar of the three allied species found in this State, which was hopping among the low bushes, scolding like a wren.

The weather here was warm and pleasant by day, but frosty at night. Insects were scarce, and I searched in vain for mollusca, though several fine snails are found on the neighboring mountains where limestone abounds. As I am, however, only giving my observations on that particular journey, I omit for the present to mention these and many higher animals, which I have since found to be inhabitants of the same region.

Large groups of Live Oak (*Quercus agrifolia*), seen at a

distance only, surrounding San Gabriel and San Bernardino, would no doubt yield many birds and other animals not observed along the route traversed.

Cajon Pass.—The pass is entered quite abruptly from the plains by a picturesque cañon, usually narrow and rocky, through which flows a dashing mountain stream, clear and cold, but not observed to contain fish. Along its banks grow Live Oaks, Buttonwoods (*Platanus Mexicanus*), and various Willows, while a few Pines (*Pinus Sabiniana?*), Firs (*Abies Douglassii*) and Nut Pines (*P. monophyllus*) straggle down from the neighboring mountains. The slopes of the nearest mountains are, however, covered chiefly with low shrubs. Among these the loud ringing trill of the Wren Titmouse (*Chamœa fasciata*) was the chief bird-music at this season. Other birds observed were a flock of Pigeons (*Columba fasciata?*), Lawrence's Goldfinch (*Chrysomitris Lawrencii*), and the Western Bluebird (*Sialia Mexicana*), none of which frequent the bare plains below. Just below the summit, where we camped December 7th, I shot the first seen of the Shining Flycatcher (*Phainopepla nitens*), a species rare west of these mountains, and peculiar enough to attract attention from its habit of flying upward from a bush to a great height, in a zigzag manner, in pursuit of insects, somewhat like Pewees, which it much resembles otherwise. I have heard of the Mountain Quail (*Oreortyx pictus*) as occurring in this spot. The Pass being only about 4000 feet above the sea, and the mountains around it low and nearly treeless, does not offer so good a field for a collector as would be the San Bernardino range, which rises over 8600 feet forty miles south-east of here, and is covered high up with heavy coniferous and oak timber. The light coating of snow which greeted our eyes on the summit the morning of December 8th, is an index of the greatest cold ever experienced here, though the summits of the highest mountains in sight are often white in patches the entire summer.

As we are now about to enter on a new natural region,

that of the interior deserts, I may as well digress a little from the line of travel to mention some other land animals I have observed west of this range, and north of latitude 34° 30′, a region which I have called the "Southern coast-slope" of California, extending north-east and south-west for about one hundred and forty miles, and fifty in breadth. Besides the mammalia mentioned, the Coast Fox (*Vulpes littoralis*), if really distinct from the Gray, does not occur northward. Deer (*Cervus Columbianus* and *C. Mexicanus?*) are not uncommon, and some small feline animals (*Felis eyra?*) with long tails, are said to occur. The Jaguar (*F. onca*) has been reported, but all other mammals except Skunks (*Mephitis occidentalis* and *M. bicolor*) are rare.

The Cougar (*Felis concolor*), Grizzly Bear (*Ursus horibilis*), Raccoon (*Procyon Hernandezii*), Badger (*Taxidea Americana*), Wild Cat (*Lynx rufus*), Gray Squirrel (*Sciurus leporinus*), Antelope (*Antilocapra Americana*) and Mountain Sheep (*Ovis montana*) occur more or less abundantly in various stations on the mountains or plains, but most of them are limited to particular spots, and are more abundant in other parts of the State.

The most peculiar birds not yet mentioned are the Contraband Hawk (*Buteo zonocercus*), which I found but once near San Diego, in February; the Rock Swift (*Panyptila melanoleuca*), a few of which breed in some cliffs near the same place; the Texan Nighthawk (*Chordeiles Texensis*), a summer visitor, the Little Vireo (*Vireo pusillus*) and Hooded Oriole (*Icterus cucullatus*), also migratory; the Long-tailed Mocking-bird (*Mimus caudatus*) and Long-billed Sparrow (*Ammodromus rostratus*), the latter confined to the seashore. These, as well as the White-bellied Auk (*Brachyramphus hypoleucus*), have not been found farther north, though the land species mostly occur farther east. Altogether I have noticed forty-eight species of mammals, and two hundred and forty-eight of birds, in this region. Of the birds thirty-two are summer visitors, thirty-two winter, and the rest resident.

Of reptiles I found twenty-eight species and six of batrachians, a few of the former are not known northward, viz., Hallowell's Rattlesnake (*Crotalus Hallowelli* nom. prov.), the Coppery Whipsnake (*Drymobius testaceus*), and Couch's Gartersnake (*Eutainia Couchii*). Two species of Gerrhonotus (*G. Webbii* and *G. olivaceus*) are also reported as only from these mountains, and I found two other undetermined lizards on the seacoast and Clauente Island. The fishes are few in the fresh water, and as yet undetermined.

On my return to the coast, just six months later, I found the summer fauna of this region in full development. The Rock Swifts flew high over the mountains with harsh croaking notes; the Vireos and Orioles sung sweetly in the high trees; the Mocking Bird, and many others, enlivened the shrubbery or chaparal, and at evening the Nighthawks flew swiftly about our camps. Humming Birds of various species had nests on the trees, of which I unfortunately upset one and broke the eggs before I saw it. Brilliant flowers abounded, and though the dry season was commencing in the plains, the mountains were so inviting that I much regretted my inability to spend a month or two there before going to the military post at San Diego.

The Desert.—The whole country between the mountains and the Colorado Valley may be called desert, although only that part near the mouth of the river is called so on the maps, being nearly level and almost as barren of vegetation as the sea-beach. The route to Fort Mojave passes over an undulating country, destitute of trees except on the summit of the San Francisco Mountains, where it rises over 5000 feet above the sea. The lower tracts consist of salt or alkaline flats, sand-hills or bare rocks, while the higher support only a scanty and useless vegetation. Junipers (*J. occidentalis*) and Nut-pines cover a few of the highest points, while a little lower the Yucca tree (*Y. baccata*) forms extensive groves. Many species of Cactaceæ, and other desert plants, form the most characteristic vegetation elsewhere.

In such a region the higher animals cannot be expected to abound, and those found are chiefly stragglers from more favored tracts, but still there are some of much interest. Descending the eastern slope we find Harris's Squirrel (*Spermophilus Harrisii*) scarce at this cold season, but common on our return in June. This little animal has much the appearance and habits of Tamias, but is nearly white. I saw also tracks of the Sage Fowl (*Centrocercus urophasianus*) corresponding in color with the granite rocks among which it lives, and have seen a specimen killed near here.

The only peculiar bird known is Leconte's Mock-thrush (*Harporhynchus Lecontei*), which is also of a pale grayish brown, like a faded specimen of the coast species (*H. redivivus*), but is admirably colored for concealment among the thorny bushes growing on the sand-hills it inhabits. Both of these animals having dark colored representatives in less barren regions, offer excellent instances of the influence of "natural selection," but have some peculiarities not to be explained by the influence of the climate and country they inhabit.

The road for nearly one hundred miles eastward follows the Mojave River, which, being permanent for half that distance, and supplying moisture to a narrow tract of bottom-land, forms a sort of oasis in the desert, cultivable, and with its upper parts lined with trees and shrubs. Some of the common Californian birds were rather frequent here, but I found none of interest at that season. On returning in June I found here the Purple-throat Humming Bird, the Little Vireo, and various other summer species. Fresh water shells of the genera *Lymnea*, *Physa* and *Planorbis* occurred, also two species of *Succinea*, in the more elevated cool parts of the valley.

It is in the class of reptiles, and especially lizards, that the fauna of the desert excels. Although none were visible in December, and I had not time to collect many on my return in June, I have ascertained that seventeen species have

been obtained chiefly in this region by various naturalists, principally those of the Mexican Boundary and Pacific Railroad Surveys. One which they seem to have overlooked, although the most remarkable, perhaps, because inhabiting such a desert region, I described, after my return, as Agassiz's Land-tortoise (*Xerobates Agassizii*). In size it is about equal to the species of the Gulf Coast, but differs in color and other particulars. The Indians hunt for them on the mountains among cacti and other fleshy-leaved plants, on which they probably feed, rarely or never descending to the valleys. A Water-turtle (*Actinemys marmorata*) also lives in the Mojave River. One small Cyprinoid fish (*Algansea formosa*) has been found by Dr. Heermann in this stream.

Towards the sink, or "Soda Lake," which rarely contains water, the sand becomes very dry and almost bare of vegetation. A few trees (*Chilopsis linearis*) of small size grow there, and among them I saw a flock of the Arctic Bluebird (*Sialia arctica*). The only other bird of interest seen east of this was the pretty Black-throated Finch (*Poospiza bilineata*), which is pretty common in the shrubby tracts.

HINTS ON TAXIDERMY.

BY C. A. WALKER.

[Continued from page 146.]

The method of collecting, preserving, and mounting birds. The first specimen procured, however imperfect, should always be preserved until a better one can be obtained. As soon as a bird has been killed, the following directions should be carefully observed. Fill the mouth, throat, nostrils and vent with cotton; also any shot holes which may be discovered. If there is any fresh blood upon the feathers,

sprinkle the spots with dust, sand, powdered chalk, or any other similar substances. These precautions being observed, all stains caused by blood or internal secretions will be prevented.

A paper tunnel should now be made in the same manner as those used by grocers, the bird placed in it with the head towards the point, and the upper part folded over and fixed in this position by means of a pin, taking care not to injure the tail feathers by bending or displacing them. The parcel should then be placed in a box, sufficiently large to accommodate it without crowding, and the remaining space filled with grass, paper, or any substance more easily obtained; this will prevent the specimen from being injured by friction. In our own portion of the country during the colder seasons, also in the more northern latitudes, a bird may be allowed to remain (in extreme cases) forty-eight hours before the operation of skinning is undertaken, but half the time is a safer rule. In the summer season it may be permitted to lie until the blood has coagulated and the limbs have stiffened; but in all tropical countries the operation cannot be effected with too great dispatch. If the specimen is allowed to remain any length of time beyond that above stated, the feathers about the head and abdomen are apt to fall off, thus rendering it more difficult to remove the skin; and the specimen often becomes unfit for preservation. Before skinning a bird, particular attention should be given to the color of the eyes, bill and legs, because these parts are liable to lose their tints after life is extinct, the color of the feathers upon the various parts of the body. Measurements should also be taken after the following manner, in feet, inches and fractions of an inch:

Total length from the tip of the bill to the end of the tail, the neck being stretched out in a straight line; length of the primary quills of the wing; total length of the bill, measuring either from the feathers on the forehead, following the curve of the ridge down to the tip, or from the angle of

the mouth in a straight line to the tip; the length of the tail feathers from the extremity to their insertion in the coccyx, together with their number; the length of the tarsus, from the centre of the metatarsal and tarsal joints; length of toes; length and general character of the nails; the distance between the tips of the wings when spread out to their full extent. It should be next observed whether it be male or female, young or adult; also, any change of plumage in winter or summer; the common name given it in the locality where it was collected; the exact date when it was killed, and every fact which can be ascertained concerning its habits. "The sex of the specimen may be ascertained after the operation of skinning has been completed, by making an incision in the side, near the vertebræ, and exposing the inner surface of the 'small of the back.' The generative organs will be found tightly bound to this region (nearly opposite to the last ribs), and separating it from the intestines. The testicles of the male are two spheroidal or ellipsoidal whitish bodies, varying from the size of a pin head to that of a hazel-nut, according to the season. The ovaries of the female, consisting of a flattened mass of spheres, variable in size with the season, will be found in the same region."* All of the above statements should be plainly written upon slips of parchment or pasteboard, with ink, and attached to the corresponding specimen, or recorded in a blank book, with a number corresponding to the one attached to the specimen.

When practicable, nests and eggs should be preserved with the birds to which they belong, and all information concerning dates and places where they were found. Drawings of specimens will also be useful, both in mounting and as a source of reference. Many may consider the above directions, or at least a greater portion of them, of not much importance, but if they are carefully observed and practiced, the value of the collection will be greatly enhanced, since such information is of the utmost importance in scien-

* Report of the Smithsonian Institution.

tific researches. Even should they not be destined for these purposes, the amateur will find his collection rendered far more interesting and instructive.

The collector should be provided with a light double-barrelled gun, the best of powder, and shot of various sizes, No. 10 being used for killing small birds, as it is least injurious to the plumage. Humming Birds should be killed with dust shot. Early in the morning and after sunset are the best periods of the day for procuring birds. If the collector be in any tropical country, he should choose early dawn for his excursions, on account of the coolness of the air. It is also the time when the birds are seen and heard in greatest numbers. Birds in tropical countries are generally so tame, that they can be easily approached and with little skill; a sufficient number can be killed in the space of two or three hours, to occupy the collector during the remainder of the day. It is a good rule *never to kill more specimens than can be preserved during the day.* In some parts of tropical America, Humming Birds, Creepers, and other small birds are shot with blow-pipes by the natives, and they are killed in this manner without the least injury to their plumage. Many are also caught by means of birdlime, and in springes, and specimens secured by these means are the best for preservation.

The method of skinning a bird.—One of the most important points of taxidermy, is a correct knowledge of the method of skinning a bird, so that when the operation is finished, the skin may be as perfect as possible and free from all stains. It is impossible for any one to mount a specimen neatly and artistically, from a soiled or mutilated skin. There are many instances, however, in which it may be necessary to mount poor skins from their rarity; these should never be rejected, for a specimen badly stuffed is better than none at all, and will answer until a more perfect one can be obtained. There are two things essential to success, viz., patience and practice; and a good store of both will enable

one to perform the operation with ease and dispatch. Care should always be taken not to stretch the skin, in order that its natural dimensions may be preserved.

Before proceeding to work, provide yourself with a cup of Indian-meal, cotton, needle and thread, scalpel and preservative. In the first place examine the bird, and if any spots of blood be discovered, sprinkle them with Indian-meal, and rub it back and forth with the fingers, supplying fresh meal from time to time; this will remove it entirely. If the blood be dry, apply a little warm water with a sponge, and wash the spot gently. In this manner I have cleaned the entire breast of a bird stained with blood. If any of the feathers are bent, they may be restored to position by immersing them in warm water. Remove the cotton from the mouth, nostrils and vent, and replace it with fresh stuffing. A piece of small but strong twine should now be passed from one nostril through the other on the opposite side, and bringing the ends downward tie them beneath the lower mandible, leaving them a little longer than the neck of the bird. This will aid the operator in turning the head back to its natural position after the operation of skinning has been finished. Now take an accurate measurement from the tip of the bill to the end of the tail; also the girth of the body behind the wings. The bird is then ready for the operation. Placing it upon its back with the tail turned towards your right hand, with the left separate the feathers from the lower extremity of the breastbone, quite down to the vent, laying them to the right and left so that the skin beneath is visible. Place the scalpel upon the lower tip of the breastbone and cut the skin from this point in a straight line to the vent, taking care not to sever the thin muscular tissue which covers the intestines; should this have become accidentally cut, thereby exposing the intestines, remove them at once, that they may not soil the feathers. The skin must now be separated from the flesh on either side of the incision by passing the flat portion of the scalpel handle be-

tween the skin and the body. It will be found that some birds have the skin bound much closer to the flesh than others by means of small ligaments; these must be severed with the scalpel. When the skin is loosened from its attachments quite down to the back, and the thigh laid bare, the latter should then be pressed inward and the skin turned back, in order that the leg may be separated from the body at the second joint, or the junction of the tibia with the fibula. Repeat the operation with the other side. Next, the rump, or that part into which the tail feathers are fixed, should be severed from the body at the junction of the last dorsal vertebra with the coccyx, taking care not to cut the skin upon the back. Should blood at any time be discovered, absorb it with Indian-meal, and the oily matter proceeding from the fat (which is to be especially avoided in all the marine species) may be absorbed with a little powdered chalk. If the bird is a large one, it may be now suspended by means of a large fish-hook with the barb filed off, and attached to a strong cord, which will aid greatly in removing the remaining part of the skin; but if it is a small one, it should be placed upright upon its breast, with the head lying backward. In this position the skin should be removed from the back and breast, by using the back of the scalpel as stated before, until the wings are reached upon both sides. These are to be severed from the body at the shoulder-joint. It will be found to be much easier to unjoint them by cutting beneath instead of above the joint. The neck having been reached, must be turned out until the back part of the skull is laid bare. Having separated the cervical vertebræ, or the vertebræ of the neck, close to the head, remove the ear by separating the thin skin by which it is bound to the ear-socket, being cautious not to injure it by tearing or cutting. By close examination it will be seen that the eyelid is bound to the edge of the socket by a thin skin; this should be completely severed, thereby freeing the lid from its attachments. The eyes

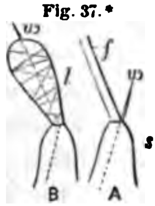
may then be removed by passing the blade of the scalpel beneath the ball and severing the optic nerve, endeavoring not to burst the former, as the humors contained within would then ooze out, and flowing through the eyelids, soil the feathers upon the head. Next cut away the tongue, together with the flesh beneath the mandibles and upon the various parts of the head, and through an opening made in the lower part of the skull carefully remove the brain. It is well to remark here that the heads of some birds are so large in comparison with the neck, as to render it impossible for the head to be turned out in the ordinary way without stretching the skin. In this case the vertebræ of the neck should be separated close to the skull, the body taken out and laid aside, and the head pulled back into its natural position. An incision is then made through the skin upon the back of the head, large enough to permit the passage of the skull, and this should then be cleaned in the same manner as stated above. Ducks, woodpeckers, flamingoes, macaws, etc., come under this rule. After the preservative has been applied to every part, and the cavities of the brain and eye filled with cotton, restore it to position, being careful to sew up the incision neatly. The wings should next be turned out, exposing two joints. The humerus may then be removed, but the double bone, consisting of the radius and the ulna, should be carefully cleaned and allowed to remain. Many taxidermists prefer to have all the bones left in their places. This, I think, should be a rule in preparing dried skins, as the wings retain their position better; but when a skin is to be mounted at once, I remove the humerus, and then find it much easier to set them. It is also a practice with many, in lieu of turning the wings, to make a longitudinal incision beneath the wing, running the length of the two first joints, and through this to remove the flesh. Lastly, the legs should be skinned, removing all the flesh, and leaving in the fibula or thigh bone. If the skin is to be mounted at once, anoint it thoroughly with powdered arsenic ap-

plied with the sifter; but if not, use the arsenical soap, because it can then be softened more readily when required for mounting. Fill the eye-sockets and cavity of the skull with cotton. Restore the leg and wing bones to position. To accomplish the latter, take hold of the tips of each, and pulling them from each other, they will easily slip into place. In turning the head back, take hold of the twine which is fastened to the bill, pulling it gently and steadily, working with the fingers when necessary, taking great care not to stretch or tear the skin of the neck. Smooth the feathers upon the various parts of the skin, and the specimen is ready for mounting.

The method of mounting a bird.—Having furnished yourself with tow, cotton, needle and thread, annealed iron wire of a size proportionate to that of the bird to be mounted, and the necessary instruments, including the large and small forceps, file, pincers, wire cutters, scissors, etc., proceed to cut fine a quantity of tow sufficient to fill the neck. With the long forceps seize a small bunch of this and insert it up through the neck and deposit it under the bill; in this manner fill from beneath the lower mandible down to the breast taking care not to insert too much stuffing or to place it unevenly. Next cut three pieces of wire; one a third longer than the total length of the body, for the main support, the other two three inches longer than the united length of the *tarsus* and *fibula*, for the leg supports; also four smaller ones five inches in length, for setting the wings and winding purposes. Sharpen each of these with the file to a fine point. Take the longest piece and bend in it three small rings, the distance between the two outer ones representing the length of the carcass of the bird, leaving one long and one short end, in the same manner as recommended in stuffing small quadrupeds. Tow should be wound about the end containing the rings, and moulded into the natural form of the body. This being completed, place the longest projecting end within the skin at the base of the neck stuffing,

and holding the head of the bird in the left hand, letting the skin hang down, with the right, insert it up through the cut tow within the neck, and thence through the top of the skull. Care must be taken not to push too hard, for by so doing you may displace the stuffing, but rather twirl the wire between the thumb and forefinger, when it will be found to penetrate easily. The skin must then be drawn over the artificial body, and the leg wires placed in position. The latter is done by placing the pointed end upon the sole of the foot, and forcing it up through the tarsus, between the skin and the bone, until the point has reached the first joint. The leg bones should then be turned out again, when the wire will appear as in Fig. 37 A, *w*. It should then be forced up a little above the top of the fibula, and cotton wound about both. This should be made to resemble the form of the flesh, which has been removed, and bound about with thread to prevent it from slipping (Fig. 37 B, *l*). The whole may then be turned back into its proper place. Now hold the protruding point against the side of the artificial body, about midway between the extremities, and force the wire through transversely, until it appears upon the opposite side, care being taken not to penetrate the skin. The end should be bent into the form of a hook, when, by taking hold of the protruding wire at the sole of the foot, and pulling it towards yourself, the hook will be firmly fastened into the body. The incision should now be closed up, by bringing the edges of the skin together, and made fast in this position with common pins; with ducks and larger birds it is necessary to sew up the lips of the incision. The legs are next brought towards each other, bending the wires close to the body until they are parallel. The joint of the fibula and tarsus should also be imitated. The bird is now ready to place upon a pedestal. All perching and climbing species should be mounted upon stands formed like the letter T; the

Fig. 37.*



* *s*, skin; *f*, fibula; *w*, wire; *l*, artificial leg.

waders, swimmers, and all other species which frequent the land or water, ought to be placed upon flat pieces of board.

Fig. 38.*

The neck can now be bent into position, and the head directed either to the front or side, according to the taste of the operator. The wings are next raised up, and placed against the sides of the body, in the same position as when the bird was living, and fastened in place by means of the short wires forced through the shoulder into the body (Fig. 38, *b*). The tail is supported by means of a wire inserted beneath the tail feathers and passed into the body (*e*).

In placing birds in certain positions, it is necessary to spread the tail feathers. This may be accomplished in a variety of ways. First, by running a small pointed wire through the shaft of every feather; this method, however, is not applicable to very small birds. Another is to take a piece of cardboard, somewhat longer than the width of the tail spread out to its full extent, and cut a horizontal slit in it of the required length; the feathers are inserted in the slit, and are retained in whatever position they have been placed. This method is practiced only upon small birds. A third method is to take a piece of wire of small size and bend it double, pressing the bent end firmly together with the pincers; the tail feathers are then arranged between the two, that is with one wire above and the other beneath them. The two loose ends are then brought together and twisted to prevent them from springing apart; also to hold the feathers more firmly (Fig. 38, *f*). The latter method is applicable to birds of any size. The two remaining short wires should next be inserted into the body, one upon the back just below the curve of the neck, the other above the rump (*c* and *d*). These are used for convenience in winding, and can be removed after the specimen is dry. The feathers should be

*a, head wire; c and d, back wires; b, wing support; e, tail support; f, tail spreader.

placed each in its proper place by means of the small forceps. If the eyes are not sufficiently plump a little cotton can be inserted through the eyelids, with a small quantity of putty, by which the glass eyes will be more firmly fixed; the latter operation should receive much care, the eye should have its natural fulness, and the eyelids should be well rounded. The bird should then be bound with thread, wound about the various protruding wires. This operation is done to keep the feathers in place until they are firmly fixed. A bird should not be allowed to *dry* too quickly, as the skin is then liable to shrink, but it should be placed in some *dry* place, not too warm, where the skin can gradually stiffen. When *dry* remove the thread, pull out the wires upon the back, and with the wire cutters, clip off the remainder close to the body. To insure success, the taxidermist should have a correct knowledge of the habits of birds, that he may place his subject in a position characteristic of the species. The measures previously taken will aid in securing accuracy of form.

Taxidermists, as a general thing, are apt to overstuff their specimens, and the beginner should strive to avoid this. There are several attitudes assumed by birds in the living state, which can be copied with advantage. To represent a bird in the flying position, its wings should be extended as far as possible, the tail placed horizontal and well expanded, the neck stretched forward and the legs drawn up close to the breast, with the toes closed. The wings may be spread by means of pointed wires inserted from the inside of the body, up through the wings beneath the skin, as far as the carpus, or fore arm. The wire can also be inserted from the outside near the joint of the carpus, and be forced down the wing between the skin and the bone, and thence transversely through the artificial body, into which it is fastened by means of a hook. These wires should be inserted before the leg wires are placed in position, and hooked into the artificial body, as in the former case. An interesting atti-

tude is when a bird is about to take flight. In this position the body should incline forward, and the wings be slightly raised; this can be accomplished by means of external wires placed beneath them, which are allowed to remain until the bird is dry. The moment of alarm is a striking position. To express this, the one foot must be stretched forward and the other drawn up near the body, and considerably bent. The body must be thrown to one side, with the wing on that side much elevated and spread out, while the other is placed lower and less diffuse; the tail must be expanded, thrown down at the point, and much arched: the neck should be stretched upward, and the head inclined towards the foot, which is drawn up; the eyelid should also be well rounded. The eagle can be placed in the position of seizing its prey, with wings and tail expanded, head thrown backward and crest erect, gazing upward. The vulture should have drooping wings to portray its sluggish habits. Such descriptions are endless, and indeed needless to a student of nature in its various details.

Remarks upon preparing, relaxing, and mounting dried skins.—The bird should be skinned in the ordinary manner, leaving *all* the bones of wings in their places, and the skin thoroughly anointed with arsenical soap. The neck should then be stuffed with chopped tow or cotton to its natural dimensions. The upper points of the humeri should be tied together at a distance from each other equal to that of the same when fixed in their sockets, otherwise the distance between the shoulder joints. The skin should next be filled with cotton or tow, and the incision sewed up, the legs turned inwards, crossed, and tied in this position, with a label attached containing descriptions.

One of the most efficacious methods of relaxing dried skins, is that employed by the ingenious Mr. Bullock. A box is made of convenient size, the top of which is free to lift on and off, without hinges or fastenings. The sides, top and bottom within are lined with a coating of plaster of

Paris, two or three inches thick. When any skins are to be relaxed, fill the box with water, and in this condition allow it to stand over night; in the morning any water remaining can be poured off, and the skins placed within. The lid of the box, being grooved, will shut close, and the wooden sides will prevent evaporation from going on. The box should be set in some damp situation. In twenty-four or forty-eight hours the skins will be sufficiently soft and pliant for mounting. It is necessary before placing the skins within the box, to render the feet and the bill pliable, that these parts should be enclosed in dampened rags or tow. Before moistening, the body should be opened and the inside stuffing taken out with the forceps. Another method is to fill the skin (the former stuffing having been previously removed) with cotton or rags saturated with water, enveloping it with a damp cloth, having wrapped the bill and feet as above stated. The former is preferable, as the latter does not relax all the parts equally. In some cases, however, especially with those of the aquatic families, it is necessary to prepare them after the latter plan, and in this condition to place them in the box described above.

The general method pursued in mounting dried skins is the same as that practiced upon fresh specimens. Difficulty is often experienced in placing the leg wires in position from the dry and shrivelled condition of the tarsi; this may be overcome by perforating them with the awl used for that purpose (recommended in the former article upon mammalia) previous to inserting the wires. With many of the skins of South American birds, prepared by the natives, a proper adjustment of the wings is found to be impossible. In this case it is necessary to cut them off close to the body, and fix them anew. In replacing the wings the scapulars should be carefully arranged to effectually conceal the joining of the wings. Any feathers disarranged in the operation should be properly adjusted with the small forceps.—*To be continued.*

A FISH FARM.

BY E. DEXTER.

Fig. 39.*

THE Fish-hatching establishment at West Barnstable was begun in the spring of 1868. The experiments have as yet been confined mostly to trout, of which we have hatched this year some 60 000, as well as 2000 salmon ova which were procured in New Brunswick by the State Commissioners of Fisheries, by whom they were presented to us. As the process of hatching goes on during the transport of the eggs in wet moss, we lost several by their hatching on the way in the cars.

The place selected for building the ponds to contain the parent trout, was a swampy piece of land at the head of a brook of considerable size, running into the salt water after a course of a mile and a half or two miles, and containing a half dozen or more pure springs, the waters of which formed

* EXPLANATION OF FIG. 39.—X, X, X, X, X, X, springs. *a*, *a*, *a*, drains. C, hatching-house. D, represents a series of ponds for young fish. E, E, E, spawning ways. *b*, *b*, plank troughs. The two ponds between E, E, E, are for spawning fish. The large pond represented by dotted lines, on the right of this, is used as a reservoir for fish. The dotted lines on the cut above the ponds represent a proposed series of ponds. A tank is also placed at this point, indicated by the X on the left of this series of proposed ponds.

the fountain head of the stream. Two ponds have thus far been made by excavation, each about forty feet long by twenty feet wide, and from three to four and a half feet deep. They are connected together, the same water being used for both ponds. The supply of water is about eighteen square inches, and is taken from tanks made of plank, varying in size from ten to fifteen feet in length, and from four to ten feet in breadth, sunk in the soft mud at the points where the springs came to the surface, and as deep as was necessary to reach the substratum of sand, which was generally about five feet. These tanks have no bottom planks, and the water wells up through the sand at the bottom, forming reservoirs of living water of even temperature, summer and winter, and not subject to freshet or variation in quantity. The temperature of the springs varies but little from 48° throughout the year.

There are now about seven hundred parent trout in the two ponds, ranging from three-quarters of a pound to three pounds in weight. It is calculated that the first pond will sustain over 2000 fish of the larger size, while in the second three times that number of smaller fish will thrive. This is allowing one large fish or three of the smaller size to the cubic foot.

They are fed daily with live minnows and shrimp caught on the adjacent salt marshes, or, when they cannot be conveniently obtained, with chopped liver, the roe of codfish, etc. The ponds are stoned, and one of them which was built in low wet land, is cemented on each side of the stones. Having learned by former experience that trout will spawn in the pond, and the ova thus be lost if its bottom is sandy or gravelly, we covered the bottom, where its nature seemed to invite the fish to this operation, with flat stones, thus obviating the difficulty so far as we have observed. Aquatic plants, mosses, etc., were introduced and now cover the bottom, not only providing a large amount of food in the form of crustacea, snails, etc., but also supplying to the water

the necessary chemical elements which are being constantly exhausted by the respiration of the fish.

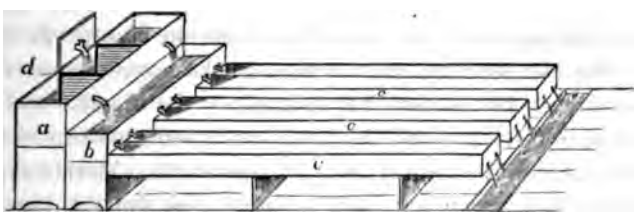
The water enters each pond through a plank trough, the sides of which are sunk nearly to the level of the ground. These troughs are fifty feet long and three and a half feet wide, and are filled to the depth of six inches with coarse gravel, over which there are six inches of water flowing with a slight current to the ponds. As it is the habit of the trout to seek shallow running streams to spawn, they eagerly resort to these *spawning ways* when ready, and are taken by closing the bottom of the way, and driving the fish into a bag net at its entrance into the pond. They are then removed in tubs of water to the *hatching house*, for the purpose of taking the ova from the female and impregnating them with the milt of the male fish. The modus operandi is as follows: The female fish is grasped with one hand by the back and shoulders, the vent being held under the surface of the water in a tin pan or other vessel partly filled, while with the other hand the abdomen is gently rubbed or pressed toward the vent. If the ova are mature and ready to be shed, a slight pressure is sufficient to extrude them. The same operation is then gone through with the male; if his milt is mature, it will flow in a small quantity into the vessel. A few drops are sufficient to impregnate thousands of eggs. The milt and the ova are then gently stirred together, and allowed to remain undisturbed for five or ten minutes. The water is then poured off, new water is gently admitted to wash the eggs, and they are ready to be placed in the hatching troughs.

It may be as well to state here that the spawning time for trout is from October till March, the principal spawning months being November and December. It is generally calculated that a trout weighing one pound will produce 1000 eggs; the larger and smaller ones in the same general proportion. I have known, however, during the past season, a trout of less than half a pound in weight, to deliver 1000 eggs by actual count.

The first requisite now is a supply of pure *spring* water for hatching the eggs,—neither too warm nor too cold. From 45° to 50° is the best. Every degree warmer or colder will make from six to eight days difference in the time of hatching. From 37° to 54° is considered the limit within which to hatch trout. By a calculation in Mr. Norris' book ("American Fish Culture"), it will take one hundred and sixty-five days with water at 37°, and thirty-two days with water at 54°.

The hatching house in the establishment we have spoken of is a wooden building twenty feet long by twelve feet

Fig. 40.



wide, into which water is admitted about three feet above the level of the floor, from springs immediately in the rear, enclosed in sunken tanks as before described, and covered so as to be out of reach of cold or heat. To enable the water to be brought in at this height from the floor, the house is sunk three feet in the ground, and the boards are covered with a heavy coat of pitch inside and out, to a point above the level of the surrounding ground to prevent their rotting. The amount of water now used in the house is what will flow through two faucets, one inch in diameter, with a moderate pressure. This is led in the first instance into a *straining trough* (Fig. 40, *a*), running across the width of the building, where it passes through flannel strainers (*d*) to insure its purity. It then flows into a *distributing trough* (*b*), which is parallel to the straining trough and a few inches lower, from which, by means of faucets, it is let on to the *hatching troughs* in such quantity as may be best.

The hatching troughs (Fig. 40, *c*) are placed at right angles to the others, and are sixteen feet long, fifteen inches wide, and eight inches deep, and are six in number with covers upon hinges, the top of them being about fifteen inches from the floor. They are lined with slate, one-half of an inch thick, upon the sides and bottom, with transverse subdivisions; every two feet made of the same material and two inches in height. A fungus growth, very detrimental to the ova, is unavoidable when wood only is used. The bottom of the troughs is covered with about one inch of moderately fine gravel, and over it flows a constant stream of screened spring water about an inch deep, the lower end of the trough being depressed two inches. On this gravel the impregnated ova are placed in a single layer. In about three weeks the eyes can be seen in the impregnated eggs, appearing simply as two black specks; the blood-vessels of the future fish may also be seen, and from this time its development may be traced daily in the shell. With the temperature of the water at 48°, we may look for the hatching of the ova from the forty-fifth to the fiftieth day. A trout just hatched is about three-eighths of an inch in length, and has attached to it an umbilical sac of several times its own bulk, which sustains the young fish for about forty days, when it is absorbed. The young fish may now be let out into the waters it is desired to stock. They will thrive if placed in a brook even at this early age, such waters supplying an abundance of minute particles of food. If reared in confinement, however, they must be fed with raw liver chopped to the consistency of blood and mixed with water, with the yolk of eggs grated very fine and treated in the same way, or thin sour curds. The latter food is perhaps the best as it sinks more slowly, and trout seize their food *in transitu*, paying little attention to it after it reaches the bottom.

We have sought only to give such a general description of a fish breeding establishment, and of the habits and treat-

ment of the fish, as would give some idea of the practical parts of the art of pisciculture. There are many details connected with the subject which we have not touched upon. They can be found very thoroughly treated of in any of the modern works on pisciculture, of which Norris' "American Fish Culture" is the latest and most practical.

In the above all general considerations have been avoided. It would, perhaps, have been as well to have stated that the arguments in favor of artificial hatching of eggs is based on the small proportion of them that are hatched when deposited in a stream, by the fish following the course of nature, and the very large proportion when hatched by artificial arrangement. The many enemies of fish spawn (other fish, water insects, birds, rats, not to speak of sediment, freshets, ice, etc., etc.) reduce the number of the eggs sadly. It has been calculated by English pisciculturalists that not one salmon reaches the proper size for the table out of every thousand eggs deposited in the stream. As the salmon migrates to the sea when weighing only a few ounces, it would, however, be more subject to casualty than the trout.

THE FRESH-WATER AQUARIUM.

BY C. B. BRIGHAM.

(Continued from page 136.)

WE have seen that the aquarium is to be distinguished from the common fish-globe by its self-supporting character. We have examined in a general way the philosophy of the aquarium and concluded that the rectangular tank was the most useful one to have. Let us now look for a situation for the tank before the specimens are placed within it. It is desirable that the sun should shine upon the tank for at least an hour during the day; an eastern or southern aspect

then is the best for this purpose. This is especially true in the winter time, while in summer a northern aspect would be preferred, as the water in the aquarium is apt to be over-heated by the sun during the hot months. One trouble which arises from too much sun is this: that the small green plants of conferva grow very rapidly upon the glass and stones, obstructing the view of the inside of the tank, and rendering the stones very hard to clean when taken out. These confervæ do not injure the water at all; they even give out oxygen as other plants, and it seems as if it were a provision of nature, that they should render the glass opaque so as to protect the inmates of the tank from injury. This confervoid growth is not essential to the welfare of the tank if it is properly stocked with other plants, and it is desira-ble to have as little as possible of it. To effect this, a wide screen, or a simple sheet of brown paper, so placed as to shut out the sunlight from the tank will answer the purpose; or by pulling the window shade down when the sun shines upon the tank; or, what is best, by placing a row of plants with full foliage between the tank and the window, we have other means of obviating the difficulty.

Whether the sun shines upon the tank or not, a fresh-water aquarium should have all the daylight it can get, both for its own welfare and for our own convenience in examination. I am convinced that this is correct from my own experience, although Mr. Hibberd, a good authority on aquarial matters, says to the contrary: "A full flood of daylight is more harm than good, a frequency of sunshine destructive, and the ten-ants of an aquarium are seen to better advantage in a vessel lighted from above only." Before any specimens are intro-duced into the tank, it should be thoroughly washed out and the glass cleaned on all sides, as this is the only time when it can be done to advantage. We are sure then that no im-purity of any kind will thus far hinder the success of the aquarium. The tank then is ready for the rock-work. This rock-work is useful: first, as a shelter for the animals, some

of them being averse to the light if it is strong; second, as a means of concealing the sediment which, without doing any material injury, so mars the beauty of an aquarium; third, as a means for anchoring in their proper place the plants we put in; fourth, and lastly, to make the effect of the aquarium more like nature.

It is generally thought that most water-plants, to do well in an aquarium, must have soil to grow in as well as land-plants, and that a layer of earth or sand must be spread over the bottom of the tank for the roots; this is found by experience to be a mistake. No earth nor sand is required for the plants which grow best in the aquarium. Either is very apt to spoil the water after remaining in contact with it a short time. Coarse sand is, to be sure, sometimes used when we have animals in the tank whose nature it is to burrow, but even then only in a small quantity placed near a corner of the tank. Some of the small lilies grow better if they have a cubic inch of peat attached to their roots. This small quantity does not injure the water, however long it may remain in it, and is often very useful. In general, however, if the plants are placed right side up, among small stones about the size of a fresh pea, they will grow to any extent, seldom throwing out roots of any kind.

We want, then, a layer of small stones on the bottom, about an inch in thickness; this will be sufficient to bury the ends of the plants in, and to conceal all the sediment which may collect, at the same time giving depth enough for the mussels to burrow in. The stones used with tar for the tops of houses are about the right size for this layer, and on the top of it some larger stones about the size of an almond may be scattered here and there. As to the color of the stones this may add greatly to the effect. If we can have the patience to pick out for ourselves the white and variegated stones from the beaches, we shall be amply repaid by their appearance in water. White stones give a brighter look to the inside of the tank than dark-colored ones, and

they show off the green plants much better; but they also show the green confervoid growths growing upon them much sooner than dark stones, and are much harder to clean after they have once become green. This difficulty of cleaning can be remedied by having two sets of stones, one being buried in damp sand while the other is in use. Were the beautiful stones of almost fabulous brilliancy which cover the San Mateo beach, near San Francisco, as common on our shores, we should have a famous groundwork for the aquarium. After the layer of small stones has been evenly spread upon the bottom of the tank, we may arrange the rock-work in the centre in the following way, which seems to be a good one, because by it we avoid using cement, which makes a tank look altogether too artificial, and we get a strong piece of work giving sufficient shelter to the animals, and one that will not be likely to fall down and injure the glass of the tank. It consists, essentially, of a series of three stone bridges, the one above being smaller than the one below. If the tank is small one or two bridges may be all sufficient. We take then two or more pieces of stone, having very rough edges so as to look more natural, and place them about a foot apart if the tank will admit of such a width, making a height of about two inches. Upon the tops of these pillars of support we place a thin flat stone, large enough to rest firmly on them, and even lap over an inch or so on each side; then upon this flat stone we place the pillars of another bridge, having the next flat stone somewhat smaller than the other, and so on until we have made so many bridges that the top one will just rest upon the surface of the water. The distance between these flat stones may vary according to the fancy of the builder. The top stone makes a little island, and gives a chance for such animals as tritons and turtles to come out and sun themselves or take the air. Another use which this top stone may be put to is this,—to support a small collection of marsh plants, making a great ornament to the aquarium.

Many of the fern-like mosses found growing on the rocks in damp places in the woods, or the swamp cowslips or violets, or the delicate plants of sundew (*Drosera rotundifolia*), or some of the kinds of arrowheads (*Sagittaria*), do perfectly well if planted in a very small quantity of soil upon this top stone. Our native pitcher plant (*Sarracenia purpurea*), and the red cardinal plant (*Lobelia cardinalis*), seem especially adapted for this purpose. If we take the former plant up in the fall and keep it growing upon the top stone until March, it will then begin to throw out its buds, and, before long, blossom most curiously. The latter plant seems to do best when taken up with the buds just appearing, and it will last long enough in flower to repay one for all the trouble of transplanting it. Various other means of beautifying the top stone may be adopted. If we wish a small collection of tropical ferns, and have room enough, we may cover them with a glass shade and have a diminutive Wardian-case, forming a part of the aquarium.

It is the custom with many to make a mound of marine-shells, or of coral, in the centre of the tank; besides being dangerous to the water from the difficulty of getting them perfectly clean, they seem quite out of place, not only because they are foreign to fresh water, but because it seems that the aquarium should be a place for living, not for dead specimens. It is far better to avoid putting in any shells, however beautiful they may be in the cabinet. Having completed the rock-work, and washed every stone carefully as it is put in, the plants are next to be attended to. In fresh-water plants we have for the most part to deal with the different shades of green, while in salt-water plants the colors are varied and brilliant. There is, however, this advantage in fresh-water plants, that almost all of them will grow well in a properly managed aquarium, while only the very green ones of the salt-water plants are likely to flourish under the same conditions. One great drawback to the growth of aquarial plants is the change of the water from a higher to a

lower temperature, or the reverse. It is also sometimes found difficult to grow several kinds in one tank successfully. The common water-cress (*Nasturtium officinale*), for example, found mostly in cold springs and their brooks, will do well with water starwort (*Callitriche verna*), a plant growing in a similar situation, if the water in the tank is kept at a low temperature; but at a moderately high one grows long and rank, and finally decays. So again many plants which grow in brooks or rivers, and have become accustomed to be constantly moved by a current, when placed in the still water of an aquarium inevitably mould away.—*To be continued.*

REVIEWS.

The Butterflies of New England.—The notice in our last number of Mr. Scudder's promised work on New England Butterflies, has already brought many welcome responses. A number of living butterflies have been sent in cotton wool, and although a day upon their journey, were received alive and in good condition; those who live near Boston might try this method, but we think that most persons would be interested in raising the larvæ themselves. In attempting to obtain eggs for this purpose, it is better not to select the freshest butterflies, as their eggs will often prove undeveloped, or at least unimpregnated. It should also be remembered that the males usually appear about a week before the females, and experiments would therefore be more likely to succeed if made about a fortnight after the species is first observed. The following butterflies can be experimented upon by the time these lines meet the reader's eye:—*Pieris oleracea*, *rapæ* and *Protodice*; *Colias Philodice*; *Anthocaris Genutia*; *Chrysophanus Americanus*; *Lycæna Lucia* and *Comyntas*; *Thecla Auburniana*, *Niphon*, *Augustus* and *Henrici*; *Argynnis Bellona*; *Pyrameis cardui*, *Huntera* and *Atalanta*; *Vanessa Milberti* and *interrogationis*, and *Hesperia Massasoit*, *Quadaquina*, *Pocahontas*, *Metea* and others. The following species, the earlier stages of which are unknown, probably feed on the plants specified:—*Anthocaris Genutia* on cruciferous plants; *Lycæna Lucia* on buckthorn; *Thecla Auburniana* on smilax; *T. Niphon* on pine; *T. Augustus* and *Henrici* on vaccinium; *Argynnis Bellona* on violets or raspberry; and the different species of *Hesperia* on poplar, scrub oak, clover, grasses and various herbaceous plants.

In answer to repeated enquiries, we will state that the males of butterflies may, in general, be distinguished from the females by a series of clasping hooks which protrude from the orifice at the tip of the abdomen; frequently these are effectually concealed by long scales. In a number of families the sexes can be determined by the partially undeveloped condition of the front legs of the male; collectors also know many species by their colors.

The proposed volume will include a history and description of the parasites of butterflies. Dr. Packard has kindly promised his assistance in describing these parasites, and examples of every kind, and in large numbers are desired. They should be accompanied by specimens of the species infested, and if possible, by such as show the mode of attack; the fullest observations on the time and manner of attack, and on the subsequent life of the insects will be acceptable. All specimens will be returned, when desired, by the end of the year.

Complete lists of the butterflies found in different localities, both in New England and the adjacent regions, are wanted, and especially if accompanied by careful memoranda of the exact times of the first appearance, and of the duration of each species. It will be necessary to receive insects from every possible quarter to arrive at a definite knowledge of their habits. To secure this more effectually, Mr. Scudder will name any local collection of butterflies sent to him with notes, at the Boston Society of Natural History, about the first of October; such collections would be returned before the first of January. For the safety, however, of his own collection, and of others entrusted to him, it will be necessary to return at once, unnamed, any collection showing traces of having been previously attacked by museum pests.

As stated last month, the amplest credit will be given in the work for every item of scientific intelligence received. We urge our readers to assist in this undertaking to the extent of their ability. With such material aid, the volume cannot fail to supply a need which has long been felt.

MONOGRAPH OF THE TRICHOPTERYGIDÆ.—Rev. A. Matthews, Market Harborough, England, is preparing an elaborate monograph of this family of Coleoptera. It will be illustrated by dissections of all the genera, which Mr. M. has made in a manner heretofore unapproached, and by figures of all the species. The style of the work may be somewhat appreciated by reference to his description and figure of *Limulinus paradoxus*, in the Annals of the Lyceum of Natural History, New York, VIII, p. 406, pl. 15.

Many new species from the United States will be figured and described in this work, which will be indispensable to the library of all learned societies which cultivate the science of entomology, and to the private libraries of investigating coleopterologists.

Persons who desire to subscribe will please order the work through any importing bookseller, and send their names to me that I may inform

the author what number of copies will be required for this country. The price will be £1.

This monograph will be executed in the best style, and we hope that a liberal subscription may be made, to diminish for the author the cost of publication.—J. L. LECONTE, *Philadelphia, Pa.*

INSECTS INJURIOUS TO FOREST TREES.—Prof. Ratzburg has published a new edition of the "Waldverderber und ihre Feinde" (Insects, etc., injurious to Forests, and their Enemies. Berlin, 1869. pp. 457, with plates, $4.50 gold).*

He has also published a new work of great value: "Die Waldverderbniss," etc. Berlin, 1868–'69. 4to, two vols., $17.00 gold, with many plates, both zoölogical and anatomical, representing forest insects.

It is an interesting fact that in the German forests, since 1867, the Ichneumon enemies (before regularly 10 per cent. in number of the injurious insects they prey upon), suddenly became 0 per cent., while the injurious insects have increased from 40 to 50 per cent. He thus accounts by this great decrease in the number of the insect parasites for the very great loss of forest trees observed in Germany within the last fifteen years.—H. HAGEN.

REVIEW OF THE SCANDINAVIAN CONTRIBUTIONS TO NATURAL HISTORY IN 1867–8. (Continued.) Sweden and Finland. By Dr. C. F. Lütken.—Many of the scientific men of Sweden have of late years been occupied by the examination of the zoölogical, botanical and geological collections brought home to Stockholm by the various exploring expeditions to Spitzberg, executed with admirable skill, energy and endurance, by several of the youngest Swedish and Finnish naturalists, under the superintendence of the Royal Swedish Academy, and the special leading and patronage of S. Lovén, and with liberal grants from the State funds. Sweden has generously taken upon itself the task of enriching science with a thorough knowledge of this most Arctic country, of its mathematical and physical geography, geology, terrestrial and marine flora and fauna, with the purpose of obtaining in this way a solid base for all the important investigations and discussions dependent on a complete knowledge of Arctic nature. In Malmgren's appendix to the "Report of the Swedish expedition to Spitzbergen in 1864," you will find a complete list of all the publications relating to the scientific investigations of this country. Many of these papers are inserted in the "Proceedings of the Swedish Academy," for 1866–68. Among the most important, I must first name Dr. Malmgren's *Annulata polychæta Spitsbergiæ, Grönlandiæ, Islandiæ et Scandinaviæ usque cognita*, a most important work, giving (with the author's previous work, "Northern Marine Annulata," published in the same periodical) a complete synopsis of all the chætopodous worms of our northern seas, with numerous descriptions of new genera and species, and many plates. Of like importance is Dr. Smitt's voluminous synopsis of the Arctic and boreal Bryozoa, which contains an enormous

* These works will be imported by the Naturalist's Book Agency at the above prices in gold.

and astonishing mass of learning and research, and has established, I believe, this part of zoögraphy on quite a new base. A profound study of the monograph is indispensable to every one who may in the future devote himself to this group; but whether all the peculiar views and conclusions advocated by Dr. Smitt will be finally adopted, is a question I am not qualified to discuss. Prof. Andersson has described a new grass (*Colpodium Malmgreni*). Dr. Cleve has reviewed the Diatomaceæ, and Dr. Lindberg the mosses of Spitzberg, while Prof. Heer* has examined the fossil (miocene) plants of Spitzberg and Walrussia, and Dr. Lindström has analyzed some of the rocks of Spitzberg. But besides these efforts of a more special character have been made the unceasing endeavors characteristic of the pupils of Linnæus, to clear up the fauna, flora, and mineral wealth of Sweden itself. I cannot here enumerate all the papers relating to this subject, but will only state that you will find several local faunas and floras, as well as special or local lists of peculiar classes of plants or animals, *i. e.*, of the fishes of Finmarken, with many critical notes by Malmgren; of the lichens of various provinces; of the Diatomaceæ of Sweden and Norway; of the birds of Sweden by Meves; various faunal, entomological and chemical researches on rare or little known Swedish minerals, etc. Among papers of a wider scope I must cite the continuation of Prof. Kinberg's "Characteristics of Annulata" collected during the voyage of the "Eugenie," a sort of prodromus of the elaborate descriptions to be given in the report of that voyage, published by the Academy; many new genera and species are established among the Amphinomeæ (the other higher groups were treated in previous volumes); and among the limivorous and sanguivorous divisions. To this series of papers also belongs Kinberg's curious observations of an annelid (*Lycaretus*), reproducing its head and anterior body segments. Prof. Kinberg has also published a paper on the "Origin of the second cervical Vertebra (*epistrophæus*) in Mammals, through the fusion together of two Vertebræ." In Mammalia, generally, the odontoid process is separated during a longer or shorter period, from the true *corpus epistrophæi* by two intervertebral epiphyses in the same manner as in all other ordinary distinct vertebræ; the odontoid process has parts answering to the arms, which are, however, not developed into true arches, but analogous to that of certain caudal vertebræ; the epistrophæus has of course two corpora fused together like the sacral vertebræ, and consequently draws its origin from the connection of two primordial vertebræ. Prof. Staal's (the Entomological Curator of the State Museum, in Stockholm) critical and diagnostical review of the Hemiptera (Reduviadæ, Hydrobatidæ, Saldæ, etc.) will, I do not doubt, add to the author's high reputation for accuracy and acumen, and might the more be recommended to the attention of American entomologists, since many American bugs are reviewed in these papers, which, written in Latin, are quite accessible to men of all

* A more detailed account is to be found in Prof. Heer's great work. "Flora fossilis Arctica," dependent principally on materials brought together by Scandinavian travellers and naturalists, and deposited in the museums of Copenhagen and Stockholm.

nations. Dr. Ljungman's descriptions of new Ophiuridæ, and his useful synopsis of all the known genera and species, with several new forms of both categories should next be noticed. Also Prof. Lovén's description of a new genus (or subgenus?) of Crinoids of the Antedon tribe (*Phanogenia typica*) from India. His description of *Leskia mirabilis*, confirming the presence of the valvulate peristome and periproct ascribed to this curious genus of Spatangidæ (*Paleostomata* Lovén) by Gray, and suggesting an interesting analogy with the Cystideæ, elucidated by some very valuable observations upon the structure of this ancient type (*vide* the Geological Magazine * for a more detailed account of this paper), and lastly but not least, the same celebrated author's ingenious memoir on the little stalked pyriform deep-sea sponge, from Finmarken, termed *Hyalonema boreale* Lovén, by means of which he demonstrated that the Lusitanian and Japanese Glass-ropes had hitherto been erroneously represented as if turned upside down.† (The paper is translated fully in the Annals and Magazine of Natural History.) Dr. Lindstrom has described a new species of the brachiopodous genus Trimerella, from the Silurian limestone of Gotland, and added some important features to the knowledge of this singular genus. He has also continued his valuable observations on the Silurian "corals" of that island, with the description of a new and supposed *true* coral (*Calocystis cribraria*), of the tribe *Eupsammida* (?), from that remote epoch, and a new *operculated* species of Cystiphyllum. Dr. Lindstrom's previous discovery of true operculata in several Cyathophylloid corals had apparently widened the gap between these ancient "Pseudo-corals" (*Anthozoa rugosa* and *tabulata*), and the true corals of later epochs but the recent discoveries by Dr. Duncan of some presumed transitional forms between both types, and the striking analogy pointed out by Lindstrom between the structure of Zaphrentis and that of Ceratanthus and Schenopus, have made him change his opinions on the subject somewhat, and "operculated corals" are now, according to the opinion of Lindstrom, a less strange and illogical combination of characters than he formerly supposed. Finally I shall cite Dr. [illegible] interesting note on *[illegible]* Pallas, demonstrating its identity with *[illegible]* Oliv. (translated in the "Annals"); also Prof. [illegible] [illegible] *[illegible] Herbarium*. Mr Raupach's notes on the earthquake at St. Thomas, November 18, and December 11, 1867; Dr. [illegible] interesting observations confirming the popular belief already advocated by Aristotle as regards the stag and horse that cows and sheep also [illegible] have the singular custom of devouring their own afterbirth;‡ Prof. Stenberg's suggestions on the applicability of lichens to the [illegible] of grape sugar and alcohol, might perhaps also be of im-

* Re[illegible] by Mr. [illegible] in the "Canadian Naturalist and Geologist," [illegible]

† [illegible] "H[illegible]" from Santa Cruz, mentioned [illegible] years [illegible] Museum of Philadelphia, would [illegible] very [illegible] Proceedings [illegible] Acad. Nat. Science, Phila., Oct. 5, 186[illegible]. Eds.)

‡ We have noticed the same habit in the cat. Eds.

portance to other northern countries, where lichens are abundant; and Mr. v. Post's observations on the so-termed "giant-kettles" (kettle-shaped excavations in rocks, with whorl-like or spiral striations, evidently produced by water-whorls turning stones around along with them) as drawing their origin from the waters rushing vertically down through local cracks in glaciers (the so-termed "moulins") throw farther light on the great glacial epoch and the monuments it left behind; no doubt also North America will furnish numerous instances of the phenomena interpreted so successfully by Mr. v. Post.

Though we are now connected by railways with the Swedish capital, I must confess that the last volume of the "Transactions of the Royal Swedish Academy of Science" which has reached us, is the sixth of the new series, or that for 1865–66; it would therefore strictly fall behind the limits of this review; but as it bears the year 1867 on the foot of the title page, I presume that some of its parts have been published so late as 1867, and I therefore shall briefly state that this volume encloses the excellent *Monographia Salicum*, by Prof. Andersson (with nine plates). One hundred and five species are described in this work by the learned author, who through many years made this genus his favorite study, and whose well deserved reputation will recommend his work to the attention of all botanists, as being that of the first authority on the subject. Mr. Zetterstedt has examined the flora of Smaland (a province of Sweden). To Durir and Nordenskjold we owe contributions to the geography of Spitzbergen (with a large and excellent chart), and a discussion on the possibility of executing a triangulation of this Arctic country, while Nordenskjold has published a geological description of it (with charts and profiles), and Lindström has described its Triassic and Jurassic fossils. Of the contents of the later volumes, if such have appeared, I am only acquainted with Dr. Paykull's (author of Travels in Iceland) geological description of Iceland (with a beautiful chart), and a paper by Mr. Malm on the structure and transformations of the *Pleuronectidæ* (flounders), wherein the author has established some facts that appear to be at variance with the explanation proposed by Steenstrup, of the migration of the eye from the lower to the upper side of the head; but as this question must yet be regarded as a partially open one, and farther contributions to its elucidation may be anticipated, I shall defer what might possibly be said on the subject to another occasion. Of the "Voyage of the Eugenie," published under the patronage of the Academy (Annulata, by Kinberg; Insecta, by Bohemann and Staal), I am not aware that anything has been published during the biennium, and the same must be said of Sundévall's unfinished "Birds of Sweden." You will find in it Prof. W. Lilljeborg's description of two subfossil whales discovered in Sweden (*Eschrichtius robustus* and *Hunterius Swedenborgii*, with eleven plates), containing also an elaborate synopsis of all known genera (or subgenera?) of "Whalebone Whales," among which the author distinguishes not less than ten generic subdivisions. As the memoir is written in English, a farther review of its contents may be unnecessary here.

Dr. Cleve has contributed a monograph of the Swedish *Zygnemaceæ* (a tribe of confervoid Algæ), illustrated by ten beautiful plates; seven genera and twenty-five species are described, and they appear (I am of course not competent to judge) to be treated of with that care and ability that one is accustomed to find in the countrymen of Linnæus. As all descriptions are translated into Latin, the paper will easily be available to all. The University of Lund has published two volumes of "*Acta Universitatis Lundensis*," for 1866 and '67. Dr. Olsson describes in full detail the *Cestoidea* and *Trematoda*, observed by himself in Scandinavian fishes; he scrutinized no less than 860 specimens of fishes, belonging to seventy-six species, and found fifty-six species of fully-developed parasitic *Platyelmintha*. Diagnoses of all the species are given in Latin, and five plates illustrate the text. Two parts are published of this work that will be indispensable to any who in America should be disposed to pursue similar studies. Dr. Quennerstedt pursues his investigations of the Swedish Infusoria, a line of research in which little or nothing has been done in Scandinavia since the time of O. Fr. Müller. Dr. Lyttkens has described the muscles, the integument and its internal portions in the Homarus (Lobster), with two plates, and in future parts will treat of the integument, etc., of Lithodes, Cancer and Pagurus. Prof. Wahlgrën has described and figured a specimen of the great Sun-fish (*Mola nasus*), and made some valuable additions to the knowledge of its anatomy. This species is the greater one of the species commonly confounded under the collective name of "*Orthagoriscus mola*," and the only one hitherto observed on the American shores of the Atlantic; while the smaller species (*M. Retzii*) is only found on the European side of the ocean, where *M. nasus*, however, is by no means uncommon; the distinctive characters were pointed out by Prof. Steenstrup and myself in 1863. Prof. Agardh has contributed a detailed monograph (in Latin) of the Laminarian Algæ, and Prof. Areschough an anatomical investigation of the leaf (with two plates). His principal conclusion is the anatomical demonstration of the fact, that the leaf is, indeed, only a metamorphosed stem (why not that the stem is, in fact, only the metamorphosed leaf); also some interesting researches on the history of the Scandinavian flora, based principally on its geographical distribution (with two charts). He points out the vestiges of three migrations, *i. e.*, that of the Arctic flora, which towards the close of the glacial epoch, migrated from Northern Siberia; the eastern and north-eastern (Altaic) element, which at a later time, after the glacial epoch and before the appearance of the *Fagus sylvestris*, wandered into Europe from Siberia (Altai); and lastly, a southern (south-eastern Caucasian) element (our common beech among the number), which at a still more recent epoch made its way into Northern Europe from the circumference of the Mediterranean, of the Black and of the Caspian Seas. Dr. Berggrën has continued his studies of the Mosses, especially on the structure and evolution of *Andreæa*. Dr. Holmström has published his researches on the glacial phenomena in Southern Sweden, illustrated by a very instructive chart, showing the direction of the ice-tracks. Dr. Lundgrën

has undertaken the critical determination and description of the petrifactions of the recently discovered Faxe-limestone in Scandinavia, while Dr. Törnkrist has studied the geological structure and chronology of the older Silurian beds in Dalarne; and Prof. Torell's description of the Scandinavian "Sparagmitis-formation,"—the oldest (Cambrian) fossiliferous layer in Scandinavia, and of its rare and highly enigmatical fossil remains, closes this very creditable series of scientific contributions published by our sister University.

Among the papers published in the "Botaniske Notiser," 1867 and '68 (edited by Prof. Th. Fries, at Upsala), I must cite Prof. Andersson's, on the genus Salix, and especially its northern species; Dr. Goës' description of the flora of the West Indian island, St. Barthélemy; Mr. Moë's valuable observations on the influence of the different mineralogical constituents of the soil upon the variation of plants; several papers on the Scandinavian species of *Callitriche*, *Junci* and *Chareæ*, *Notulæ-lichenologica*, and other geodesical contributions, among which some observations on the variation of the parts of the cone in the common *Pinus abies* should be particularly noticed by botanists and palæophytologists. In every volume of this highly esteemed journal, a complete annual list is given of all botanical papers published in Sweden, Norway and Denmark.

The work of the celebrated mycologist, Elias Fries, on the edible and poisonous mushrooms of Sweden, has been finished, and a new work on the rarer species of this class is in course of publication. Of the great geological chart of Sweden, published by the State Geological Survey, under the direction of Prof. Erdmann, twenty-five sheets have appeared. The editor has also published a volume on "The Quarternary Beds of Sweden" (with fourteen charts, profiles, etc.), giving a detailed account of the glacial, post-glacial, etc., formations of this country, where these layers have, I believe, been more fully studied than elsewhere; and though I am no competent judge in this matter either, I cannot but believe that Prof. Erdmann's synopsis of the results arrived at, and the researches carried out in Sweden, must be of great importance to the geologists of all northern countries where similar formations occur. The topic of "The Glacial Epoch in Northern Europe" has also been treated of in a more popular manner by Dr. Paykull, in a special pamphlet. Dr. Lindström has published a careful and critical list of the recent and subfossil mollusca of the isle of Gotland, and discussed at length their geographical distribution beyond the narrow limits of his island; three plates with figures of teeth, jaws, etc., are added. Mr. Malm, the Curator of the Museum at Göteborg, has published the fourth and fifth parts of his "Zoölogical Observations" (reprinted from the Transactions of the Royal Society of Göteborg). Though the fourth part had been printed as early as 1863, it was not, I believe, circulated before the last year, and I shall therefore give a review of the different chapters: "a List of Marine Mollusca observed in the brackish water of Göteborg, and in the estuary of the Göta-elf;" "a Monograph of the Syrphici (a family of

Diptera) of Scandinavia and Finland"; "a Review of the Scandinavian *Petromyzontidæ*," in which the author proposes a new terminology of the teeth of these fishes, divides the old genus Petromyzon into *Lampetra* (*marina* Linn.), and *Petromyzon* (*fluviatilis*, *Omalii* and *Planeri*), and cites for the first time *P. Omalii* B., as found in Scandinavia. The *P. Planeri* of Haeckel and Kner, he holds to be distinct from that of Northern Europe; a list of Fishes, Crustacea and Mollusca, new to the Scandinavian fauna, *i. e.*, *Scomber grex* Mitchell?, *Scopelus Kröyeri* (n. sp.), *Acanthias*? *sturioides* (n. sp.), *Eurynome tenuicornis* (n. sp.), *Vanbenedenia Kröyeri* ([illegible]), new genus and species, with figures of a crustacean parasitic on Chimæra, being found attached to the apex of the dorsal spine), *Nucula tenuidula* (n. sp.), *Turbonilla umbilicaris* (n. sp.), *Trophon Mörchii* (n. sp.); a Note on *Limnæa limosa*, under which name the author unites a series of forms, hitherto commonly regarded as distinct species (*L. Balthica*, *L. limosa*, *Bennetti*, *succinea*, *vulgaris*, *ovata*, *peregra*), but forming in fact an uninterrupted series of varieties, no doubt derived from the different external agencies and local circumstances that have affected their life and external form; some Remarks on Monstrosities occasioned by a *Syngnathus typhle*, with a double caudal fin; a Monograph of the *Hirudineæ* of Sweden, with beautiful figures from life. In an Appendix several Arctic species are described, and farther additions may be found in the Report of the Association of Scandinavian naturalists, for 1863; a Monograph of the *[illegible]*, also with handsome illustrations drawn from the living animals. The same active zoologist has also published, in French, a *Monographie illustrée d'une Baleinoptère* [illegible] (Göteborg, Oct., 1866, [illegible]). It is well printed and illustrated by a series of photographs, but not of that scientific importance which might have been anticipated. On the other hand it may be argued that the author's energetic endeavors to secure not only the skeleton, but also the stuffed skin, in such a state that it gives a faithful representation of the animal's appearance, deserves to be fully acknowledged, the more as his health suffered by this gigantic work and the expense was not repaid by the exhibition of a "Malmö Whale," at Stockholm and elsewhere. The species Malm describes as new (*M[illegible]*), but it has been noticed by Messrs. Flower and Reinhardt to be most likely the *B[illegible]* Gray. The same author has also contributed some notes on the skeleton of *B[illegible]* to the "Proceedings of the Royal Swedish Academy."

From Finland, that last outpost of Scandinavian civilization towards the East, as is now [illegible] another part towards the South, I have not much to report, though natural history was ever cultivated with zeal and success by the people, half Swedish half Finnish, inhabiting this [illegible] favored country, as you will learn from a paper by Prof. [illegible] "[illegible] Study of Natural History in Finland before the time of Linnæus," in the "Contributions to the Knowledge of the Nature and People of Finland," No. 12, published by the Society of Sciences at Helsingfors. In another number you will find "Geological Observations on the South western part of Finland." In the *Acta Societatis Scientiarum Fennicæ* (vol. VIII.), Prof.

Mäklin has published an elaborate monograph of the Strongylium-tribe (heteromerous Coleoptera), with four plates. An interesting biography of the late Prof. Nordenskjold, the celebrated mineralogist and geologist, is also given in the same volume. In the "Proceedings of the Finnish Society of Science" Prof. Lindberg has published several smaller botanical papers, *i. e.*, "On a New Species of *Pimelia* (*P. vividula*) and *Musschea* (*M. pallescens*)"; and "On an abnormal fructification in *Passiflora*," etc.

NATURAL HISTORY MISCELLANY.

BOTANY.

A New Fragaria.—The Fragaria which I venture, after a careful examination of all the authors within my reach, to pronounce a new one, was brought from Jalapa, Mexico, in the fall of 1858, to Michigan, by Mr. F. Mack. Only one plant survived the journey. From that originated the extensive plantation of J. P. Whiting & Co., of Detroit, who are in vain endeavoring to supply the Western demand for plants, at $3 a dozen. It is known in Michigan as the Mexican Ever-bearing Strawberry, and, according to most reliable testimony, it richly deserves its name. From early June into October—indeed so long as sunlight has strength to ripen berries—it is busy in putting forth fresh flowers and maturing fruit. It is hardy and exceedingly prolific. Its fruit is large, firm, fragrant, sweet, and exquisitely flavored. It belongs to that section of the genus which bears its achenes, or carpels, superficially on the receptacle, and is distinguished from all its congeners by its dichotomous stem and racemose flowers.

In justice to Henry Gillman, Esq., the active and meritorious botanist who first indicated its claims to specific rank, as well as in token of my warm regard for him, I propose for it the name of *Fragaria Gillmani*; and I characterize it thus:

Fragaria Gillmani,—Caule dichotomo, foliis ternatis, foliolis petiolatis, floribus hermaphroditis racemosis, carpellibus superficialibus.

I annex a detailed description furnished by Mr. Gillman:

Stem erect, longer than the leaves, dichotomous, racemose, many-flowered, bearing a perfect trifoliate leaf variously situated from below the middle to the summit of the peduncle, which is clothed with a spreading or deflexed pubescence, more silky, and ascending or appressed on the pedicles and calyx. Leaves coriaceous, coarsely serrate, the serratures ovate-mucronate, rugose, silky villous, the hairs closely appressed, particularly beneath, leaflets petiolate, the two lateral leaflets unequal towards the base, borne on long channelled footstalks, which are clothed with spreading or deflexed hairs. Flower perfect, eight lines in diameter; calyx segments not longer than the roundish spreading petals, the exterior segments or bractlets often cleft or parted, much smaller than the interior segments, which are ovate-lanceolate. Fruit drooping, but always raised far above the ground on the erect stem; bright scarlet, of an irregular conical form, gratefully sweet, sub-acid, singularly fragrant; achenia numerous,

superficial (not sunk in pits), closely covering the surface of the berry, which is produced continuously from June to November. Propagating very rapidly by stolons or runners; also by side stools or offshoots from the central crown, which are tuberous and easily separated. Height of plant twelve to fifteen inches. Perennial; May to November. — [G. W. CLINTON, *Buffalo*.

ZOÖLOGY.

NEW SALAMANDER. — Prof E. D. Cope informs us that he has just discovered an interesting genus of Salamanders from Mexico. It differs from *Spelerpes*, in having the parietal and palatine bones unossified, and the inner nares opening into the orbits. The phenygoid teeth are in one patch. Toes, four on the front feet and five on the hind, rudimentary. The tail is as long as the head and body together. The total length is only two inches. It has a pale dorsal band and black sides. A female specimen contained eggs one line in diameter. He has called the species, which is a new generic type, *Thorius pennatulus*.

BREEDING OF RARE BIRDS. - Mr. G. A. Boardman, of Milltown, Me., writes us (Nov., 1868) that he collected the nests and eggs of the following birds in the spring of 1868: — Goshawk, Canada Jay, White-winged Crossbill, Pine Finch, and the Pine Grosbeak.

TENNESSEE WARBLER. — In the June (1868) NATURALIST, Mr. Tripp in his interesting article, states that this warbler is not found in New England, or only as a straggler. With us it is one of our very common warblers, and I can collect half a dozen almost any morning about the twentieth of May. A few remain through the season — G. A. BOARDMAN.

PERCHING OF WILSON'S SNIPE. -- In the August 1868 NATURALIST you ask if, like Mr. Pope, any one has observed Wilson's Snipe on trees? This is not an uncommon habit of the bird, when you are taking its nest or catching its young; but I have never observed it at any other time. Of our sixteen species of ducks, I have observed the same thing in all but two, when trying to catch their young. G. A. B.

MICROSCOPY.

TYPE-PLATE OF DIATOMS. Moller of Wedel, Holstein, has accomplished the most wonderful feat of modern manipulation, with the exception, perhaps, of Nobert's ruled lines. The slides he prepares have been described to us in the letter of a correspondent, who is the fortunate possessor of two. "The diatoms four hundred species in all, arranged by genera and species, form groups of one hundred, set with the most perfect regularity and symmetry, and the whole occupies a space of about three sixteenths of an inch. Each slide is a cabinet, a collection in itself, and is accompanied by a catalogue of its contents. This one is called the 'Type Plate,' and cost $10.00. The 'Test Plate,' from the same operator, contains, set in one row with the most perfect regularity, twenty tests, by order of difficulty."

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.—The Eighteenth Meeting of the Association will be held in SALEM, commencing on Wednesday, August 18, at 10 o'clock, A. M. Arrangements are in progress by the Local Committee to make the meeting a scientific success, and a large attendance from all parts of the country is expected.

An interesting feature of the meeting is anticipated in the proposed microscopical gathering, and a large room will be specially devoted to the display of Microscopes, and all that pertains thereto. The Local Committee respectfully requests all persons having first-class instruments, to bring them to the meeting, and also such apparatus as they have found useful in their manipulation. Agents and makers of Microscopes are requested to bring specimens of their different manufactures.

On the afternoon of the first day of the meeting, the Association will be invited to assist in the dedication of the Museum of the Peabody Academy of Science. The Rooms of the Essex Institute and of the Academy, also those of other institutions of the city, will be open during the meeting.

The meetings of the Association will take place in the several halls of the County Court Houses which furnish most ample accommodation for the different sections and committees. The office of the Local Committee will be at the new Court House, where members will be conducted immediately on their arrival in the city.

A circular giving all necessary information relating to the meeting, will be sent to any one requesting it, on application to the Local Secretary. The volume of Proceedings for the Chicago meeting is now nearly printed, and will be ready for delivery at this meeting.

Any person wishing to join the Association can report his name to any of the Secretaries. The entrance fee is $5, and the annual assessment is $3, including the price of the yearly volume of Proceedings.

Farther information relating to the Association can be had by addressing the Local Secretary, F. W. PUTNAM, *Salem, Mass.*

ANSWERS TO CORRESPONDENTS.

J. T., Tabor, Tarrant Co., Iowa.—The impressions are the casts of the crinoid stems found fossil in the rock, from which the pebbles were originally broken off.

E. L. H., Newark, N. Y.—The insect was too much injured for specific identification: it is a hemipterous insect allied to *Reduvius*.

R. T., Brookfield, Mo.—The specimens sent were undoubtedly the fungus attacking the larva of the June Bug (*Lachnosterna fusca*), which has been described and figured in Riley's recent Report on the Insects of Missouri injurious to Vegetation.

J. H., Albany, Oregon.—The insects were duly received; many thanks for them. There are several that seem very familiar forms, while some of the moths appear to be new to science.

A. H. G., Plymouth, Ind. — Parasitic worms, in various stages of development, are commonly found in fishes, and it is most probable that every individual has several distinct kinds of parasitic worms living either in the intestines, liver, etc. See p. 218.

W. C. C., Ithaca, N. Y. — The Milleped is *Spirobolus marginatus* Say.

CORRECTIONS. — Dr. Cooper, of San Francisco (who did not see the proofs of his articles on "The Fauna of Montana Territory"), writes us to make the following corrections:

Vol. II, p. 530, line 22, for Mauvaise Territory, *read* Mauvaises Terres. On p. 534, line 18, for Washington Territory, *read* Montana Territory. On p. 535, line 14, for Bat, *read* Rat. On p. 537, last line but one, for Mammal, *read* Manual.

Vol. III, p. 32, dele the query (?) after *Seiurus Noveboracensis*. On p. 34, line 14, for N. W., *read* Arizona. On p. 34, TOWNSEND'S FLYCATCHER, mark out last two lines of paragraph after the word OSCINES, *and insert* "Yet this bird is a magnificent singer in spring." On p. 35, line 10, *Vireo olivaceus? V. Bartramii* Swainson? should read *Vireo olivaceus*. On p. 35, line 17, for *V. gilvus* read *V. Swainsonii* Baird. On p. 78, line 4 from bottom, for *Passerculus* read *Passerculus*. Dr. Cooper writes that we are correct in regard to the Editorial note under *Salmo Suckleyi*, on p. 127.

Vol. III, Pl. 2. "The artist has inserted conic teeth in the jaws of the Hadrosaurus which do not exist. The claws of Lælaps are incorrect, not being nearly sufficiently hooked. The nostril is much more anterior than given in the drawing. The eyes of Mosasaurus are not symmetrical; in the same way, one of those of Elasmosaurus is vertical and one lateral. The tail of Elasmosaurus is not continuous with what ought to be tail, but is made body." — E. D. COPE.

BOOKS RECEIVED.

Seventeenth Annual Report of the Directors of the New York Ophthalmic Hospital, 1869. New York, 1869. 8vo, pp. 15.

A Contribution to the Study of Human Milk. By T. F. Allen, M. D. Albany, 1869. 8vo, pp. 11.

Action of Anæsthetics on the Blood Corpuscles. By J. H. McQuillen, M. D. Philadelphia, 1869. 8vo, pp. 7.

Land and Fresh-water Shells of North America. Part 1. *Pulmonata geophila*. By W. G. Binney and T. Bland. 8vo, 1869. Smithsonian Institution, Washington, D. C.

Flora of Alaska. By J. T. Rothrock, M. D. 8vo, pp. 30. Smithsonian Institution, 1868.

Washburn and Co's Amateur Cultivators' Guide to the Flower and Kitchen Garden, containing a Descriptive List of two thousand varieties of Flower and Vegetable Seeds, also a List of French Hybrid Gladiolus raised and imported by Washburn & Co. Boston, Mass. Illustrated. 8vo, pp. 152.

The Naturalist's Note Book. March, April, 1869. London. 4d. a number. Small 4to.

Chemical News. March, April, May. New York.

Cosmos. February 27, May 1, 1869. London.

Observations on the genus Unio, together with Descriptions of New Species in the Family Unionidæ, and Descriptions of New Species of the Melanidæ and Paludinæ. By Isaac Lea, LL. D. 4to, with twenty-six plates. Philadelphia, 1869. From the Journal of the Academy of Natural Sciences, Vol. XII.

Hardwicke's Science Gossip. March, April, 1869. London.

The Butterflies of North America. By W. H. Edwards, Philadelphia. Part 3. $2.50.

Scientific Opinion. Parts iv, March; v, April, 1869. London.

Le Naturaliste Canadien, No. iv, March; No. v, April, 1869. 8vo. Quebec.

American Bee Journal. April, 1869. Washington. S. Wagner. $2.00.

The Canadian Naturalist and Geologist. New Series, Vol. iii, No. 5, June, 1868. No. 6, December, 1868. 8vo. $3.00 gold.

Investigations in the Military and Anthropological Statistics of American Soldiers. By B. A. Gould, Ph. D., Actuary to the U. S. Sanitary Commission. New York, 1869. 8vo, pp. 655.

The Physical Basis of Life. By Prof. T. H. Huxley. Yale Courant Office. 8vo, pp. 24.

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SEA-SIDE ORNITHOLOGY.

BY T. M. BREWER, M. D.

THE ornithology of our New England seaboard at the present day is very far from presenting either the interest, the variety or the sources of excitement, which, even within a single generation, were, from Long Island to Grand Menan, features so characteristic. If we go back yet farther, though only to a period within the recollection of that very respectable individual, "the oldest inhabitant," the changes from that recent period to what is now witnessed are yet more remarkable, and make our present poverty both striking and painful. Then wild-ducks are said to have nested on the outer Brewsters. Then, probably, the now exterminated *Alca impennis* was a bird of New England, as it was at some period, probably more distant, one of Massachusetts also. Then all our salt marshes and our lowlands near the sea swarmed, during the spring and autumn months, with plover, snipe, godwit, tatler, curlew, and wading birds of various forms and plumage. Then all of our estuaries, inlets, coves, bays, rivers and creeks along the entire coast, abounded in sea-fowl during the entire year, the only difference being that at certain seasons of the year, the resident species were driven by the ice and

the severity of the winter to more open waters, where their numbers were immensely reinforced by myriads of sea-ducks from more northern seas, and which are so absurdly designated by fishermen and gunners as "Coots." The numbers of these wild-ducks, of various kinds, off our entire coast, according to tradition, appear to have been well-nigh fabulous. Then, too, all the islands along the entire coast abounded with several varieties of gulls and terns, some of which are no longer to be met with, and all in very greatly diminished numbers.

Now how changed the whole scene! Wild-ducks no longer breed on any portion of our entire coast. The exceptions are so very few that they only prove the too general rule. Here and there a few remote uninhabited islands aside from the haunts of fishermen, and remote from the tracks of commerce, afford to a solitary species of gull, and to the decimated terns a precarious retreat, where, late in the season, a few succeed in rearing their young, and thus in postponing the day of the final extermination of their race. For, so long as the Solons of our General Court encourage, by their legislation, their unchecked and wholesale destruction, the day cannot be far distant when these graceful and harmless birds will have become wholly, as they are now almost, a "bright vision of the past."

Thus, with the increase of population along the coast during the warmer months, when the portions least frequented at other times swarm with pleasure-seekers, and with the ceaseless activity with which every island is ransacked by the insatiate "toilers of the sea," the distinctive characteristics of our maritime ornithology has become very nearly destroyed. So many blanks and gaps now mar its symmetry, and dwarf its once fair proportions, that the subject loses nearly all the claims it would have presented half a century ago.

In speaking of what is left to us of the sea-side ornithology of New England, four or five groups suggest themselves

as still distinctive features. These are: the birds of prey chiefly found about the sea-coast; the smaller land-birds that are also maritime in their partialities; shore-birds or waders; sea-birds or swimmers; and occasional and winter visitants. As we do not propose to prepare such an article as Prof. Lowell would call "nothing if not a catalogue," and our limits do not permit an exhaustive sketch, we shall only briefly speak of those we regard as the most distinguishing characteristics of our seaboard, mentioning only a few that best typify these general divisions.

The birds of prey that seem to belong to our seaboard are not many, either in their variety of species or in the number of the individuals. Even the Fish-hawk, so marked a feature on the sea-coast of New Jersey, finds our rocky shores an uncongenial or an unprofitable field, and is seldom seen from Cape Cod to Cape Elizabeth. A few occur on both shores of Long Island Sound. From thence until we come to the mouth of the Kennebec, they are entirely wanting. The same is very nearly true of the White-headed Eagle. On the coast of Maine both of these birds abound, and their large and conspicuous nests, surmounting the tops of the loftiest pines, often in full view of the highway, are a noticeable feature in the landscape.

In the latter part of the summer and in the early fall, when the southward flight of many of the small birds has begun, the Barred Owls station themselves in ambush on the coast and among the inner islands, as if to forestall the gunners, who show them no mercy if they chance to meet them. Their noiseless flight and their inconspicuous plumage, so closely assimilating with the sandy dunes and rocky wastes, favor their success as marauders, and also their immunity from their rival hunters. The flight of the smaller waders and the young of the terns are their chief attraction at these times to the sea-shore.

Less than twenty years ago our shores abounded, in spring and fall, with the Rough-legged Buzzard. They frequented

the marshes and the edges of ponds in the lowlands near the sea, rarely going more than a mile or two inland. They appeared to hunt, by preference, for frogs, field-mice, and the smaller quadrupeds, and, more rarely, the smaller birds. For some unexplained reason their visits are now comparatively very rare. The Black-hawk, by some supposed to be only a darker race of this species, and once occasionally to be met with, is now unknown.

The Great-footed Falcon, though by no means confined to our coast, is yet a conspicuous feature to the sea-side whenever or wherever there are sea-fowl to attract him. But, with the ever increasing diminution of these attractions, this falcon now only pays us angel visits, except on the eastern coast of Maine.

In enumerating the conspicuous and characteristic features of our coast scenery, the crow must not be forgotten. Wherever muscles or clams can be dug at low water, or wherever a storm has thrown upon the shore an unusual accumulation of garbage, we find these sagacious wreckers on the alert, eager to gather their full share of the *flotson* or *jetson*, as the case may be. Among our sea-side visitors, this invaluable but unpopular race are among the first to come, and the last of the migratory birds to leave our coast, and a few remain all winter.

The entire family of swallows, except the Purple Martin, are eminently sea-side birds; and most so, the White-bellied. In the eastern portions of Maine, and in all the islands of the Bay of Fundy, the abundance of this swallow is very remarkable. In Massachusetts they are far more abundant near the coast than in the interior. The Barn Swallow has been educated into resorting to the use of sheds, barns, porches, and eaves of houses for a nesting-place, yet we ca remember when the rocks of Newport and Nahant wer their primitive and natural breeding-places. The Cliff Swa lows, since 1839, have become more and more abunda on our coast. The Sand Martin has ever been content

occupy every convenient cliff, or river bank, or ocean front, in whose suitable soil it could excavate its necessary channel to a nest-hole.

Along the shores of Connecticut and Rhode Island, and occasionally on those of our own State, two interesting little *Ammodrami*, the sharp-tailed, and the sea-side *Finches*,—so called, in our poverty of terms to properly designate American forms having only a remote resemblance to that which they are intended to represent,—are species peculiarly characteristic of the sea-shore and peculiar to our own continent, there being two Atlantic and one Pacific varieties. Their elongated and slender bills distinguishing them from all other American sparrows, their long legs extending in the stuffed specimen beyond their tail feathers, their short lateral claws, their rounded wings and wedge-shaped tails composed of stiff lanceolate feathers, are all features eminently characteristic of sea-side life, and such as typify, only in a more marked degree, the true shore-birds. In fact in their habits they are not very unlike the true wader in many respects. Like them they feed upon marine insects and the smaller crustacea, keeping about the water's edge, walking upon the floating weeds and other substances raised by the tide, preferring this mode of life to a more inland residence, and only resorting to the uplands to feed upon grass and other seed when food fails them at the water's edge. They were once quite common on our northern shores, but, so far as the writer knows, a large proportion have disappeared, with other summer shore-birds, probably driven away by the gunners and pleasure-seekers who now frequent their former haunts. I have met with none, north of New Bedford, since 1840, although here and there in a few localities a few are yet to be found, as for instance, in the marshes of Charles River.

Closely allied to the *ammodrami* is the Swamp Sparrow, common to the lowlands of the sea-side, but not peculiar to them, and equally abundant in the lowlands of the interior, as far west as Wisconsin. It is found along our entire coast,

s hardly distinguishable in its habits from the sea-side rows. The Savannah Sparrow, though only occasionally d breeding so far to the south as Massachusetts, is evi- tly a sea-sider, preferring the open dunes in the vicinity the sea, and feeding chiefly on the grass and other seeds nd in these wild and uncultivated places. Among the lands on the coast of Maine, as well as on the uplands bor- ering the sea-shore, it is a very abundant species. It nests n sunken places in the ground, often on the edges of cliffs, under cover of a projecting portion of the bank. In their habits they resemble the Song Sparrow, and their notes, though thinner and not so sweet, have many points of re- semblance.

Another land bird, as yet quite rare and but little known, the Yellow-bellied Flycatcher,* so far as observed, is a bird affecting the sea-side. In the low marshy woods near Halifax, on the islands of Grand Menan over the water's edge, and on the banks of the St. Croix, in New Brunswick, these flycatchers have been observed and their nests ob- tained. That it is not exclusively a bird of the sea-shore would appear from the fact that it has been also obtained at the same season on the western shore of Lake Michigan. If found during summer on any part of our coast this side of Eastport, is as yet not ascertained.

The Belted Kingfisher, though chiefly an inland bird, and often found breeding in the interior, remote from any water, is still to be mentioned as one of the birds which, under favor- able circumstances, enlivens the sea-side with his presence, his curious piscatorial habits, and his loud and rattling notes.

Leaving now the land forms that are characteristic of, or are found near the sea-shore, we pass to those water birds that may still be regarded as belonging to the maritime por- tions of New England. Of the Herons, five at least are summer residents near our sea-coast, breed within the

* The *Empidonax flaviventris*, though ranked as a *clamator*, or screamer, in modern systems, is actually a good singer, as is also the *E. Acadicus*, as Mr. J. A. Allen informs me, and, probably, also one or two other species of this genus.

marshy woodlands that skirt the ocean, and fish along the edges of creeks, in the more shallow water and pools of the marshes, or in the flats left bare by the receding tide. These are the Green, the Night, and the great Blue Herons, the Least and the Common Bittern. Three others, the smaller Blue Heron, the Snowy Egret, and the larger White Egret, in the calm weather of midsummer, are occasionally tempted to visit our coast. They are, however, only vagrant and adventurous individuals, and their visits are rare, accidental, and irregular. Nor are our resident species very abundant. The absence of large tracts of low swampy woods near the seaboard is not favorable to their protection or increase among us.

In the marshes and low swampy islands near the coast, occur in more or less abundance the Common Sora or Carolina Rail, the Virginia Rail, the American Coot, and the Florida Gallinule. The last two are not common, but both I am persuaded breeds with us, the evidence of which will sooner or later be made to appear by the actual discovery of their nests and eggs. The young of both have been obtained in our marshes in midsummer, and the Florida Gallinule has also been obtained near Boston in midwinter.

Of the true plovers only one, the Piping Plover (*Ægialites melodus*), is common to our sea-beaches during the breeding season. The Killdeer is found only in a few inland localities. The Golden, the Black-bellied, and the Ring Plover, are only spring and autumn visitants to our coast; and Wilson's Plover, if found at all, is only a vagrant wanderer that has been tempted to stray into a strange region. It does not belong to our coast, and if ever, is very rarely found. Once numerous on the beaches of Nantasket and Chelsea, but now nearly or quite driven from them, the Piping Plover is still found along the coast of Maine and in the less frequented portions of our own shore, and is one of their most interesting features. It is met with on the entire Atlantic coast, from Florida to the St. Lawrence, and is nowhere

more common than in the least frequented portions of Cape Cod. Although living in pairs, they are also a very social bird, and where undisturbed, several pairs usually select the same locality and live in friendly companionship, uniting in the fall with their young, in small flocks of twenty or thirty. They are found exclusively on sandy shores and low islands, and are never met with inland. They nest directly on the sand, relying directly upon their resemblance to it in the color of their plumage for their own safety and that of their eggs. Their young can run with remarkable celerity the moment they appear. At the approach of danger, or at the sound of an alarm-note from their parent, they will squat, in the most amusing manner, upon the sand, as still and motionless as so many little gray pebbles, and will almost suffer you to tread upon them before they will move. In the meanwhile the mother bird will be resorting to every imaginable form of lameness, or pretence of wounded disability, to draw you away from her young fledglings.

The common Spotted Sandpiper, though equally abundant throughout the interior, and found wherever there is any lowland, must also be mentioned as among our sea-side species. In many of its habits it strongly resembles our common plover, differing chiefly in its peculiar flight, the tilting motions of its tail and body, and its sonorous outcries of *peet-weet, peet-weet.*

The Turnstone is, with us, only a rare and occasional visitant, coming in semiannual migrations, but never giving us more than a transient visit. The Oyster-catcher, a Southern coast-bird and belonging chiefly to the regions south of Cape May, occasionally wanders as far north as Marshfield, and is entitled to this passing mention as one of the very remarkable forms, which, though very rare, are a very striking feature when present in the seaboard ornithology.

We pass, with mere mention, the Woodcock, the Upland Plover, and the Solitary Tattler, as properly upland and inland birds, and the whole family of *Tringidæ*, or Sand-

pipers, Tatlers and Snipe, all of which are only autumnal and vernal visitants of the sea-coast. The time was when these constituted a much more marked feature of the maritime region than they now present, when the marshy ground, at certain seasons, seemed all alive with their countless flocks. But in these respects the times are sadly altered, never, in all probability to be improved. One species only deserves special mention, alike for its peculiar habits and its exceptional character. The Willet, the only representative of the genus *Symphemia*, is found along our entire coast, as far to the north, certainly, as Halifax, N. S., where I have met with it breeding, finding its nest and eggs. Mr. Audubon was mistaken when he stated it was never met with east of Boston. It is a very shy and wary bird. Even when breeding it is usually very quiet when its nest is approached, until the eggs are about to hatch, or after the young have appeared. Then it becomes as remarkable for its clamor, and vociferates its loud cries of *pill-will-will-willett* with great emphasis and distinctness. The Willet breeds in the sandy marshes of Nantucket and its neighboring islands, constructing a well-made nest of woven wire-grass, and the eggs, quite large for the bird, are sharply pointed at one end, and are always placed with this end turned towards the centre of the nest. After the close of the breeding season they resume their shy and silent habits, and are sometimes known among sportsmen as "*humilities*." Their eggs, when fresh, are esteemed a great luxury where they are sufficiently common to be well known, as near Norfolk, Va.

Of the sea-fowl that now spend the warm season on our sea-coast, the list is not large and but little need be said. Vague traditions are all that now assure us that some six or seven species of sea-ducks once bred among the islands of Massachusetts. Except the Dusky Duck, which is an occasional exception, none of these now remain with us; only at the extreme eastern portions of Maine, the Eider Duck and the Red-breasted Merganser continue to construct their ex-

posed and often plundered nests. The Cormorants, two species of which once nested on our rocky cliffs, have long since left us. The Herring Gulls have all been driven as far east as Passamaquoddy. Only the Black-headed Gull, a Southern and somewhat rare species, and four varieties of Terns still breed on the islands off our coast. This gull (*Xema atricilla*) was formerly quite abundant along our entire New England coast, as far east as the Penobscot. It is now chiefly found on a few islands off Connecticut, near Nantucket, and on the coast of Maine, near St. George. It visits our coast late in May or early in June, and leaves us early in the fall, upon the first appearance of cool weather. Some twenty-nine or thirty years since two or three pairs were still breeding on Egg Rock, near Nahant, in company with the Wilson's Tern, but long since they have entirely disappeared. This gull, when its nest is disturbed, is very demonstrative in its protests, and its loud outcries of *hâ-hâ-hâ*, resembling loud peals of derisive laughter, are very remarkable and even startling in their singularity.

The Least Tern, the Arctic Tern, Wilson's Tern, and the Roseate Tern, still breed on our coast, and, except the last, along the entire coast of New England. The Roseate is chiefly confined to the neighborhood of Nantucket, and the southern coast of Connecticut. It once bred on islands near Beverly. The eggs of all these species are much sought for by the fishermen, and as they are rarely permitted to rear their young, the day of their final extermination cannot be far distant.

After midsummer our waters are visited for a few weeks by two species of Petrels, or Mother Carey's Chickens (*Thalassidroma Wilsonii* and *T. Leachii*). They are outsiders altogether, never visiting the land except during the breeding season. Where the former breed is still shrouded in mystery. They appear in our waters early in August, but where they come from, or where they remain eleven months in the year, "nobody mentions for nobody knows." The

other species, Leach's Petrel, breeds off the coast on nearly all the islands from Cape Elizabeth to Newfoundland, appearing in May and leaving in September.

Later in the season the open waters are visited by flocks of ducks, most of them known to the fishermen as "Coots." There are twelve or fifteen varieties, more or less common, which our exhausted space will not permit us to enumerate. Numerous as these may at certain seasons seem to be, they come now in decimated numbers, and are so severely hunted on their feeding grounds that but very few remain with us to spend the winter in our waters.

In midwinter the outer waters of our coast are frequented by several remarkable forms of sea-birds, combining several of the peculiarities of the albatros, the gull, and the petrel, and presenting a very singular and striking union of the more noticeable characteristics of each. They never appear with us near the land. They can therefore be only observed at a season of the year least favorable for marine explorations. Our knowledge of them must be therefore largely derived from the observations of unscientific persons who meet them in their winter fishery. They are classed by Mr. Lawrence in the tribe of *Longipennes*. Three belong to the family of Procellaridæ, namely, the Fulmar or Fulmar Petrel, and at least two species of Shearwater Puffins. Others, called Skua Gulls, or Jagers, are placed among the *Laridæ*. Their habits are, however, as well as their forms, very different from those of the true Gulls. Four species of these Jagers, in company with several species of Gulls, spend their winter off our coast, and are to be met with there at no other time. The study of their habits, no doubt replete with as much of interest as of novelty, is still reserved for those students of science for whom the difficulties and the dangers of their investigations may give an added claim to their undertaking. Certainly we know of no species of our Atlantic coast-birds whose history is so much involved in doubt, or which promise more of interest in their investigations.

NOTES ON THE ARGONAUT.

BY W. H. DALL.

THE Argonaut, or Paper-sailor, is familiar to all who live in seaports; its elegant form and delicate texture making it deservedly a favorite ornament for table or mantel; and certainly nothing can be more exquisite than a perfect specimen of one of the larger species. It is of a snowy whiteness, with delicate undulating ridges, and the keel ornamented with a regular series of conical projections or tubercles, which near the spire are lightly touched with black. Perhaps its greatest charm is its perfect symmetry, in which it is only equalled by the pearly Nautilus which, however, it far surpasses in its sculpture, fragility and purity.

The Argonaut shell is formed, curiously enough, by the females only; as among more highly organized beings sometimes, the gentler sex outshine their brothers in the splendor of their apparel, and the extent it occupies. Unlike many, however, the Argonaut toils not, neither does she spin. Folding her arms about her, in her earliest infancy, she is speedily arrayed in all her glory, and has not shown any discontent at the old fashions since the time of Aristotle.

These animals are true cuttle-fish of the eight armed type. The male Argonaut is an insignificant shell-less creature, fond of retirement, solitary and rarely seen. When the tender passion seizes him, as he rocks on some sunny wavelet,* far from female society, he does not go in search of a wife, but with Spartan courage, detaches one of his eight hands (or arms) and consigns it to the deep, in the hope that some tender hearted individual of the other sex will fall in with it and take it under her protection. Thus for a long time the male Argonaut was unknown, the arm (which does not die when detached, but lives an independent worm-like life

* The Argonauts have been observed floating on the water.

was, when found in the gill-chamber of the female, supposed to be a parasite, and was called *Hecto-cotylus*.

The shelly matter is secreted by the first pair, or dorsal arms, which are broadly expanded towards the ends, and also by the sides of the body, which are more closely connected with the shell than many naturalists have supposed. But there are no true muscular attachments as in other mollusca, of the animal to the shell.

I have seen fine specimens of Argonauta in the cabinet of Mr. Arnold, of Worcester, collected by himself; showing where the shell had been broken and repaired, the new layer in some places having been deposited by the sides of the body from the *inside* of the shell, and in others by the expanded arms from the outside. The anterior edges of these arms, however, seem to possess alone the power of secreting calcareous matter, as the fractures toward the spire were repaired with a deposit more membranous or horny than shelly.

The cuttle was, in more modern times, long supposed to have stolen its shell from some mollusk resembling Carinaria, known as the glassy Nautilus. The shell of Carinaria is very similar, taken by itself, to that of Argonauta straitened out, but it serves a totally different purpose. The Argonaut, separated from its shell, was described by Rafinesque as Todarus, he having described at the same time one of the large naked cuttles, as Ocythoë. According to his own account, his description being short and careless, the two were confounded. He says that the Sicilian fishermen call the Argonaut "*todaru*"; that the apex of the shell is blackened by a dark liquor which it emits, although it has not the ink-bag of the Sepias; and that the color of the eggs is black.

The animal was well known to the ancients as the inhabitant of its own shell, though they described it with poetical fancy, as sailing in pleasant weather on the surface, using its broad arms as sails, and the others as oars, and when the

sky became overcast, storm threatened or high wind arose, as drawing in its sails and seeking safety beneath the waves. It was the original "Nautilus," the pearly Nautilus being unknown to them.

The Argonaut swims rapidly by ejecting water through its siphon,—a large tube quite distinct from the mouth. This tube is placed just above the keel of the shell, and the large broad arms are always closely applied to the shell, though they can be slightly contracted. If the animal is removed from its shell, it cannot get into it again. It probably cannot form a new one for reasons already mentioned. Deprived of its protection, it beats itself about blindly till it dies.

The eggs have been said to be deposited *inside* of the spire. I think that this is a mistake. In the specimens I have seen, they are agglutinated to the outside of the apex, inside of the last whorl, as represented by M. Rang. (See Woodward's Manual, fig. 32.)

I believe the Argonauts are of limited distribution. Some extend over larger areas than others, particularly the Pacific species. But it is probable that when our knowledge of the subject is increased by a greater number of observations, we shall find that these beautiful creatures have their boundaries, outside of which they may rarely or never be found. Many species have been confounded, as the shells all closely resemble one another. *Argonauta argo* has been reported from the Mediterranean, to which it is strictly confined; from the Indian Ocean, Philippines, and even from California! For the last species I have proposed the specific name of *Pacifica*, as a comparison with Mediterranean specimens shows that, aside from the question of distribution, the shells differ. As an example of the probably limited distribution of these mollusca, I note as follows:

In 1849, M. Noury, captain of a French frigate, obtained a new and very distinct and beautiful Argonaut, from the whaling grounds off the coast of Peru, in Lat. 10° south. It

was described by M. Lorois in the "Révue et Mag. de Zoologie," in 1852, as *A. Nouryi*. Mr. Conrad, in his monograph of the genus, mentions that Capt. O. Swain, of Nantucket, in 1850, obtained a number of this species in the same vicinity. They were observed on the surface of the water on a perfectly calm day, when the sun was very hot. They appeared in large numbers, in one group at first, and then dispersed in smaller groups of twos and threes, moving with great rapidity over the surface. Approaching them with great caution, a number were secured. A year or two ago Capt. Dow, well known as an indefatigable collector, sent to the Smithsonian Institution two fine specimens captured in Lat. 10° south, Long. 90° west, almost the same spot whence they were originally obtained by M. Noury. So far as I am able to ascertain they have not been elsewhere detected. In one of them the ova, of a red color and very small, were agglutinated to the outside of the spire, as previously noted.

It is pleasant to add that our first detailed account of the Argonaut and its development, was published by a lady, Madame Power, who made her observations in the Mediterranean, having a sort of marine enclosure made, where she kept these animals and observed their habits from life.

ON THE PARASITIC HABITS OF CRUSTACEA.

BY A. E. VERRILL.

There are few subjects pertaining to the study of animals more curious and interesting than the various phenomena connected with the parasitism of certain species upon others. This subject is also one that has many important practical bearings, since our worst crop-destroying insects are kept in check mainly by insect parasites, feeding either on the eggs, the larvæ, or the mature insect. Our domestic animals also.

and most quadrupeds, birds and fishes used as food, are afflicted, and often suffer greatly from parasitic insects, crustacea and worms; and even man himself is likewise the prey of numerous parasites, both external and internal, some of which, like the *Trichina spiralis*, often cause painful diseases and even death. But the subject has also a peculiar interest, when philosophically considered in connection with the varied phenomena of life and the theories of the origin of species. But at the present time it is our purpose merely to call attention to some curious facts concerning the habits of Crustacea, hoping that it may induce the readers of the NATURALIST to study more carefully the habits of this class, which, in this respect, is still very imperfectly known.

It is certainly singular that a very great majority of all animal parasites belong to the Articulate division of the animal kingdom, while very few are found among the Radiates, Mollusca, and Vertebrates.

The three great classes of Articulates each have numerous parasitic representatives. The external parasites of land animals are mostly Insects, and their internal parasites are Worms; but the external parasites of aquatic animals are mostly Crustacea, while their internal parasites are both Crustacea and Worms.

The class of Crustacea is naturally divided into three great groups, or subclasses. The highest, known as *Decapods*, have five pair of legs, hence their name, which signifies ten-footed. The lobsters and crabs are good examples. The next great group have seven pair of legs, or are fourteen-footed, hence their name *Tetradecapods*. The pill-bugs and sow-bugs are familiar land species. The lowest division, known as *Entomostraca*, have fewer mouth organs, and their legs are irregular in number and position, while the abdomen has no appendages and often amounts to a mere spine, as in the Limulus, or "Horseshoe Crab," which is a huge representative of the group, while most of the other species are quite small.

Although many of the Entomostraca, like Cyclops, Cypris, etc., are active and free swimming little creatures, which swarm in our ditches and ponds during summer, there are a great many forms that are true parasites, and infest fishes and other aquatic animals. These are mostly low and degraded species, in which the females become enormously developed, as compared with the minute males, and take on very singular shapes, losing, in many cases, by the progress of growth, all resemblance to their original form. In fact in some cases when mature they would scarcely be taken for Crustacea at all, had not their development been observed. Among these singular forms are a great number of genera which adhere to the external surface of fishes, and others to the gills and the membranes of the mouth. Lernea, and allied genera, are common upon various marine fishes. Penella, with its long quill-like body, lives on fishes. Clavella, which has also a very elongated form, lives upon the halibut; Trebius and Pandarus infest sharks, etc.; Caligus has numerous species which live on various marine fishes, and Argulus is common upon fresh-water fishes, and is also found on tadpoles. Prof. Dana, who many years ago carefully studied a species of Caligus* that lives upon the cod, states that it does not suck the blood, as had been supposed, and thinks that it feeds upon the mucus, as its mouth-parts are well adapted for that purpose. But Lernea, Penella, and their allies, adhere only by their proboscis, which is embedded in the skin, and often barbed with hooks, and probably serves to suck the blood. Some forms of Entomostraca allied to these, are internal parasites of serpents.

A very singular genus called Splanchnotrophus, lives as true internal parasites in various naked marine mollusca, on the British coasts. *S. brevipes* infests *Doto coronata* and *Eolis rufibranchialis*, while *S. gracilis* is found in *Doris pilosa* and *Idalia aspera*. Since some of these mollusca inhabit also the coast of New England, we may expect to

* *C. Americanus* Dana. American Journal of Science, Vol. 34, p. 225.

find these or similar parasites. The male lives free in the visceral cavity, but the female is much larger and stationary, and as the ovaries develop, the clusters of eggs and tip of the abdomen project through the integuments of its victim. Another Entomostracean genus, Doridicola, contains small active species which are external parasites on the gills of similar mollusca.

The Tetradecapods are not so often parasitic as the Entomostraca, yet many curious parasites of fishes, etc., belong to this division. The Isopod order, including the pill-bugs, and many aquatic species having a similar depressed form, contains more parasitic species than does the Amphipod order, which includes the compressed species.

Among the parasitic Isopods we find some curious species which live parasitically in the mouth of fishes, usually adhering firmly to the roof of the mouth by means of their numerous strong and sharp claws, and in that situation often grow so large as to almost entirely fill the mouth, causing no doubt a great amount of suffering to the helpless fish, and, perhaps, eventually its death by starvation. Such are the habits of certain species of Livoneca and allied genera, while other similar species live upon the exterior and in the gill-cavity, both of marine and fresh-water fishes. I have recently found an allied form in the stomach of a toad-fish from Florida, where it appeared to be truly parasitic. It was nearly an inch long and half as wide. Nerocila, Anilocra, and Cymothoa, are allied genera, including numerous species, all of which are parasitic on or in fishes. These genera have a more or less, oval or oblong, broad, stout depressed body, with short crooked legs beneath, armed with sharp claws. Some of these species become three inches long and nearly an inch broad, and must be very annoying.

Another related group of Isopods includes Bopyrus and Jone, with allied genera, which are parasitic on other Crustacea. In these the males are small, and have the ordinary

Isopod form, but the female by excessive growth becomes five or six times as large, deformed in shape, and firmly adherent in the gill-cavity of its host, where it produces a deformity and enlargement of the carapax, looking like a large tumor. *Jone thoracicus* infests a species of Callianassa; *Bopyrus squillarum* victimizes a species of Squilla; and *B. Hippolites* infests various northern species of Hippolyte. It was observed last season by Mr. S. I. Smith and the author, at Eastport, Me., on *H. Sowerbyi*. Several other species are known having similar habits.

Among the Amphipods we find Themisto and Hyperia, parasitic on the large jelly-fishes of our coast, especially Cyanea and Aurelia. Hyperia is very common, and may be known by its large head and eyes and swollen body, which is usually of a dull reddish color. They live and breed in cavities that they themselves form in the disk of the jelly-fishes, by eating away its soft substance. They also live among the mouth-folds and ovarial lobes, often in large numbers and of all sizes; but they occasionally leave their victim for a time and swim freely in the water. Mr. Smith has reared our native species by feeding them on fragments of jelly-fishes, and ascertained that they undergo considerable changes, the antennæ becoming shorter at successive moults, showing that some of the nominal species, based on the length of these organs, are merely stages of growth of one species. Several other parasitic Amphipods were observed by Mr. Smith and the writer, at Eastport. One small species with bright golden eyes lived in the interior of *Modiolaria lævigata*. Another pretty, pale-pink, smooth, red-eyed species was found repeatedly living parasitically in the stomach of our large Red Sea-anemone (*Urticina crassicornis*), but was seldom seen until the Urticina had been placed in alcohol, when several would often come forth and move about for a short time, but occasionally they were observed to come forth voluntarily, and after swimming about for some time would suddenly dart

into the mouth again, as if for protection! Nor did they seem to suffer any harm when caught and held for a long time in the grasp of the large tentacles of the anemone, as often happened, but when finally released were as lively as ever, and quite as willing to voluntarily enter the mouth. And yet the tentacles of Urticina are covered with myriads of powerful stinging organs, by means of which it can almost instantly kill various other larger crustacea, mollusca, fishes, etc., which are also quickly digested in its capacious stomach. The immunity that this species of Amphipod enjoys is evidently similar to that of Hyperia, which revels among and consumes the very powerfully armed, stinging tentacles of Cyanea, which so quickly kill most other small marine animals, and even severely sting the human skin. A pink-colored species of Anonyx was observed in immense numbers upon and in a species of sponge, upon which it appears to be parasitic, at least while young. The various species of Caprella, remarkable for their long slender bodies and legs, and their curious looping gait, recalling the motion of Geometrid larvæ, appear to be parasitic on Hydroids and sponges. The Whale-louse (*Cyamus*) is allied to these, but has a short and broad body, with stout legs and claws, by which it clings to the skin in the manner of Cymothoa and other fish-lice.

The Decapod Crustacea afford, however, some still more curious instances, though they are seldom true parasites, if by this term we designate parasites that obtain their food at the expense of another by sucking its blood or absorbing its digested nutriment. But among the Decapods we find many species that are parasitic in or on other animals for the sake of shelter and protection, while in other cases there are such singular associations formed between two or more different species, that it becomes difficult to tell which is the host and which the parasite, or whether it may not be an arrangement for mutual benefit. Most persons have no doubt seen the little crab, with a smooth, rounded body,

that lives in the interior of the shell between the gills of the oyster, and is often cooked with that excellent bivalve. This is the *Pinnotheres ostreum* (Fig. 41), and is doubtless parasitic in the oyster merely for the sake of shelter, and probably does not injure the oyster unless by the irritation that its motions might cause. But it is doubtless an unwelcome guest, though the ancients had a notion that a similar species inhabiting the Pinna acted as a sort of sentinel by giving notice of danger, and thus warned the Pinna when to close. Hence its name, which signifies Pinna-guardian.

Fig. 41.

Another species, *P. maculatum*, lives in mussels (*Mytilus*) upon our coast. Another lives at Panama in a species of Lithodomus, a shell allied to Mytilus, but which is itself parasitic, and lives in holes which it excavates in other shells and corals. There are many other species of Pinnotheres, and allied genera, having similar habits. One fine species* lives in the Pearl Oyster (*Margaritophora fimbriata*) of the Bay of Panama. It often shares its secure pearly retreat with a curious slender fish, and with two other genera of Crustacea, very different from itself, resembling craw-fishes or miniature lobsters in form. The most common of these is a new species of Pontonia,† a genus previously known to be

* *Pinnotheres margarita* Smith, sp. nov., female. Body covered with a very short and close pubescence, looking very much like a uniform coating of mud. Carapax quite thick and hard, considerably broader than long, and strongly convex; cardiac region protuberant and separated from the branchial and gastric regions by a deep depression, which extends along the cervical suture to the hepatic region; front strongly deflexed, and with a slight median depression. Chelipeds very stout, the fingers acuminate and curved at the tips. Ambulatory legs rather stout; dactyli in the first three pairs short, curved, and pubescent nearly to the tips, except in the right leg of the second pair, where the dactylus is very long, almost straight, and wholly naked; in the posterior pair the dactyli are long, straight, slender and pubescent. Length of carapax, 11.8 millimeters; breadth, 13.8.

† *Pontonia margarita* Smith, sp. nov. Body and all the appendages smooth and naked. Carapex very broad, depressed; rostrum short, sharp and slender at the tip; a slender spine on the anterior margin at the base of the antennæ. Eyes small, the cornea smaller than the peduncle. Flagella of the antennulæ short, the inner ones slender; the outer ones of about the same length, stout, fusiform. Anterior legs slen-

parasitic in the shell of Tridacna, of the East Indies, and in the large Pinna of South Carolina. Another genus, Pinnixia, allied to Pinnotheres, has two Carolina species. *P. cylindrica* Say, lives in the tubular burrow of a large worm, *Arenicola cristata;* the other, *P. Chætopterana* St., lives in the strong tube of another large worm, *Chætopterus pergamentaceus* St. Another allied form, remarkable for its nearly globose body and hairy legs, *Pinnaxodes Chilensis* Smith (*Fabia Chilensis* Dana), lives upon the coast of Peru and Chili in the shell of a small species of Sea-urchin (*Euryechinus imbecillis* Verrill), which it causes to grow out of shape. It appears to enter the anal opening when quite small, and retaining its position until fully grown, causes the intestine to dilate into a sort of cyst, and the anal area and upper part of the shell to become deformed. When fully grown it often fills nearly a third of the body of its host, and yet has but a small external orifice, out of which it probably cannot come, but the male, being much smaller, may readily enter. From the fact that nearly all the specimens of this Sea-urchin found thrown upon the beach, amounting to over one hundred, had this parasite, it is probable that it eventually weakens or kills its host by the irritation it produces.

Another very singular genus, *Harpalocarcinus marsupialis* St., lives among the branches of *Pocillipora cæspitosa*, at the Hawaiian Islands, and by its constant motions while remaining in one spot causes the coral to grow up around itself so as to form as perfect and secure a residence as could be desired, while openings are left to admit water and food. I have observed similar cavities on *Pocillipora elongata*

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der, hands small, about half as long as the carpus; legs of the second pair stout, the hands somewhat unequal and much longer than the carapax, much swollen, fingers compressed, their inner edges sharp, the dactylus slender, and with a single tooth in the middle fitting neatly into a corresponding notch in the propodus; succeeding legs slender and cylindrical, the dactyli very short and bi-unguiculate, the terminal unguiculus strongly curved, and a shorter one very much hooked at its base. Abdomen small, the first six segments slightly exceeding in length the length of the carapax. Length of body 20 to 30 millimeters.

from Ceylon, which are probably made by another species of the same genus. The genera Trapezia and Tetralia include small, smooth and polished, usually bright-colored crabs, which live free among the branches of *Pocillipora* and *Madrepora*. For this mode of life they are well adapted, both by their smooth, flat bodies, and by their peculiar feet, which are blunt at the end and furnished with sharp stiff spines to aid them in climbing among the coral branches. *Domecia hispida* has the same habits.

The Hermit or Soldier Crabs, are interesting in their habits, and well known to all sea-side naturalists. They always occupy the dead shell of some spiral Gasteropod, which they carry about on their backs, and into which they retreat when alarmed, holding it firmly by means of the long, spirally-curved abdomen, and by its hook-like appendages. But some species are apparently not satisfied with even this protection, and consequently induce certain species of Sea-anemones to dwell upon the shell they inhabit. The beautiful Sea-anemones belonging to the genera, Adamsia and Calliactis, are rarely found except in this situation. *Adamsia maculata*, of the European coast, attaches itself to the shell occupied by *Eupagurus Prideauxii*, near the inner lip, and spreads out its base laterally on each side until the lobes thus formed meet around the aperture and coalesce so as to form a complete ring, through which the crab emerges and retreats. The base of this Adamsia also has the unusual power of secreting a thin but firm pellicle, by which it extends the edges of the aperture of the shell, thus giving the crab more room, as it grows larger, and obviating the necessity of changing the shell, as other less-favored hermits are obliged to do. Several specimens of Calliactis usually occupy the same shell, and are not known to be capable of extending its aperture. All the species are very beautifully colored, and inhabit tropical seas. In the West Indies *C. bicolor* and *C. tricolor* are common, and one species occurs at Florida, while *C. variegata* occurs at Panama. *Cereus sol*

has the same habit, and occurs on the Carolina coasts. On our own shores the shells occupied by Hermit Crabs are usually completely covered by a beautiful little pinkish Hydroid (*Hydractinia polyclina* Agassiz), which at times extends the lip of the shell by its basal expansions. A still more curious instance of this kind is afforded by the *Gemmaria Americana* Verrill* (Fig. 42), a Zoanthoid polyp, allied to the Sea-anemones, but capable of budding from basal expansions, by which means it completely covers shells occupied by *Eupagurus pubescens*. After thus covering the shell, it is not only capable of extending the aperture by its own growth, but has the power of entirely dissolving and absorbing the substance of the shell so that no trace of it can be found, though the form is perfectly preserved by the somewhat rigid membrane of the polyp. This species has been found in deep water, off the coast of New Jersey, and in Massachusetts Bay.

Fig. 42.

Another still more remarkable case occurs in the China Sea. A Hermit Crab (*Diogenes Edwardsii* St.) found there has upon the outside of the large claw a circular, smooth space, upon which there is always found a small Sea-anemone (*Sagartia Paguri* Verrill). This appears to be an association for life, since very young crabs carry a very minute Sagartia, no larger than a pin's head, and large crabs have a large Sargartia. In this case when the crab retreats into its shell and folds down the large claw over the aperture, the Sargartia would appear to be attached within the aperture, and thus conceal and perhaps protect the crab. In all these and other similar cases, the advantage of association is doubtless mutual, for while the Sea-anemones, by means of their outspread tentacles, armed with stinging organs, of which fishes and other voracious animals have a wholesome

* Memoirs of the Boston Society of Natural History, Vol. i, pages 34 and 45.

dread, serve to protect the crab, the latter can more effectually travel about and seek food, and while tearing its prey into small pieces, many choice bits doubtless fall to the lot of its companion.

There is another group allied to the Hermits, the species of which often carry a valve of some bivalve shell upon the back for protection. At Florida and in the West Indies, *Hypoconcha arcuata* St., is found carrying a valve of Venus, or some similar shell, while at Panama *H. Panamensis* Smith* carries a valve of *Pecten ventricosus*, holding it on by means of the two posterior pair of legs, which are bent up over the back, aided by the posterior part of the body, which fits into the cavity below the hinge. An allied genus contains a species found from Florida to Brazil, *Dromidia Antillensis*, which carries upon its back, according to Dr. Stimpson, either a compound Ascidian or a Zoanthoid Polyp, but all the specimens in the Museum of Yale College carry a peculiar fleshy sponge, which fits upon and entirely covers the back, but is held in position by the four posterior legs. A peculiar genus of crabs, Dorippe, found on the coast of China, though not very nearly related to the two preceding, agrees with them in having the carapax broad and depressed, and in having the two posterior pairs of legs twisted up over the back, as if to hold on a bivalve shell, which may be their usual habit; but one of the species, *D. facchino*, was dredged at Hong Kong, carrying upon its back a beautiful Sea-anemone, *Cancrisocia expansa* St.,† which completely covers the back of the crab, and, like *Adamsia*, secretes from its base a thin, firm pellicle, to which it adheres, and by which the crab holds it in position with his four posterior

* *Hypoconcha Panamensis* Smith, sp. nov. Allied to *H. arcuata* Stimp. The carapax however, is narrower, the length equalling the breadth; the anterior margin not so regularly arcuate, and its edge broken by a marked median incision, and by distinct notches at the insertion of the antennæ; the projection in the anterior part of the lateral margin much less abrupt and less prominent; the lower surface of the facial region sparsely granulated, the granules separated by smooth spaces; terminal segment of the male abdomen smooth. Length of carapax in a male, 17.5 millimeters; breadth 17.3.

† This species, as it appears expanded upon the back of the crab, has been figured in the Proceedings of the Essex Institute, Vol. vi.

legs. It appears that when very young the crab holds over its back a minute bit of shell or gravel upon which the Anemone lodges, and afterwards, by expanding its basal pellicle as the crab grows, provides it with a permanent protection. This Anemone was never found except upon the crab's back, and the crab was not found without it. A very different crab found at Panama, *Hepatella amica* Smith,* carries upon its back *Sagartia carcinophila* Verrill, but in this case the connection is probably less intimate, and not so permanent.

THE HALIOTIS, OR PEARLY EAR-SHELL.

BY ROBERT E. C. STEARNS.

THERE is a family of Mollusca whose beautiful shells are frequently seen ornamenting the parlor mantel or centre table, the admiration of all on account of the brilliant colors and iridescence of their pearly interiors.

These shells are popularly called Sea-ears, but the scientific name is *Haliotis*, from the Greek *halios*, marine, and *otis*, ear. In the different countries where these shells are found, there are local names by which they are known. In California the people call them *Abalones*, while they are called "*Meerohren* by the Germans, *Telinga maloli* or *Bia sacatsjo* by the Malays, and *Hovileij* by the Amboynese," according to Adanson. "The Eolians gave it the pretty name of Venus's Ear. It is the 'Mother-of-pearl,' or 'Nor-

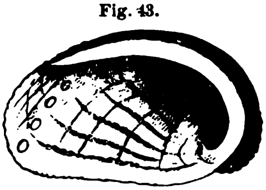
* *Hepatella amica* Smith, gen. et., sp. nov. The genus *Hepatella* differs from *Hepatus* in having the carapax rectangular in outline, in the much larger facial region, the very small eyes and very short eye peduncles, and in wanting wholly the depression below the orbit; the carapax is also much thicker, and the lateral regions are concave above. In this species the gastric and posterior branchial regions are protuberant and granulous, as is also the middle of the cardiac region, the rest of the carapax smooth; the lateral margins nearly parallel posteriorly but rounded anteriorly, the edge thin and armed with about twelve irregular and sharp teeth; ambulatory legs very short and crested; the sternum deeply punctate and vermiculated, and the male abdomen very narrow, acutely pointed, and five jointed. Length of carapax, 11.5 millimetres; breadth 15.8.

man-shell' of old English writers; '*Ormier*' (contracted from *oreille-de-mer*) of the French, '*Lapa burra*' of the Portuguese, '*Orecchiale*' of the Italians, and '*Patella reale*' of the Sicilians." The Cherbourg fish-women call it, according to Jeffreys, "*Si ieu*" (six yeux), from an idea that the orifices in the shells are real eyelets or peep-holes.

The shells of Haliotis are, through ignorance, frequently confounded with those of the *Meleagrina margaritifera*, or pearl-bearing oyster, which is the true mother-of-pearl shell, from which are obtained the beautiful pearls used in the manufacture of various articles of jewelry. The Meleagrinæ are bivalves, their shelly covering being composed of two pieces or valves, as is the case with the common oyster, scallop and clam, while the Haliotis has an univalve shell, complete in one piece or valve, without joint or hinge.

The Haliotides belong to the class Gasteropoda (*gaster*, belly, *pous*, feet), which comprises species of Mollusks that are characterized by their creeping upon, or by means of a muscular expansion of the body, called a foot. They belong to the order of Scutibranchiata (*scutum*, a shield, *branchiæ*, gills), the gills, or lung, being protected by a shield of shelly or calcareous matter. The shells of Haliotis, however, resemble, in general outline, the form of the human ear; several of the species, of which as many as eighty are known, are rough externally though brilliant within.

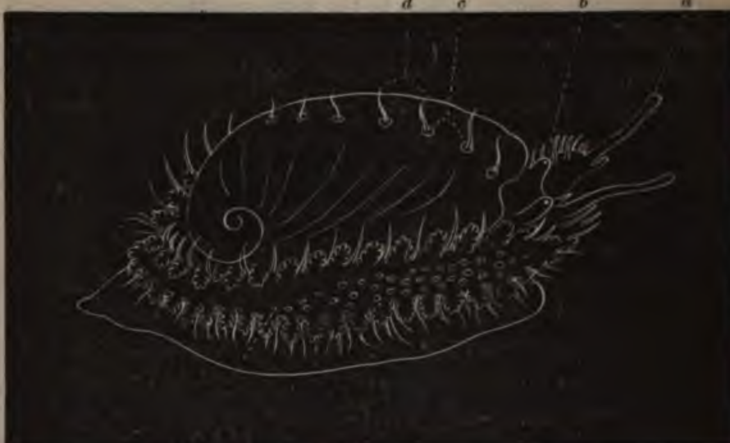
Fig. 43.



The shell of Haliotis (Fig. 43) may be compared to a flattened Turbo, or top-shell, with small apex whorls and a disproportionately large body or basal whorl, depressed, largely open, and having but a slightly elevated spire, composed of but few whorls. Again, as regards form, it holds the same position in comparison with Turbo that Concholepas does to Purpura, Sigaretus to Natica, and to follow the analogies into the Geophila, Vitrina to the more closely whorled trochiform land species.

The animal (Fig. 44; *a*, tentacle; *b*, eyes; *c*, holes in the shell for the passage of the tentacles, *d* and *f*; *e*, foot) adheres to the rock like the Patellas and Fissurellas. To the latter genus it is somewhat allied through its anatomy; the arrangement of the teeth upon the lingual ribbon is said to be like that of Trochus. Cuvier found that every individual he examined had an ovary, and therefore concluded

Fig. 44.



that the Haliotides were hermaphrodites.* Swainson considered them as occupying a position among the phytophagous, or vegetable eating gasteropods, analogous to the Volutidæ among the Zoophaga, or carnivorous mollusks; the analogy being particularly apparent by a comparison of Haliotis with the Melo group of the Volutes.

The chief peculiarity of these animals is, that their shells are perforated with a regular series of holes for the passage

* In July, 1867, specimens of the shells of Haliotis, from Monterey, were received by me, which combined the peculiarities of the two very distinct species, *H. rufescens* and *H. Cracherodii*, to a remarkable degree. These abnormal forms are of exceedingly rare occurrence, and in the great number of specimens that I have examined, I have been unable to obtain additional illustrations. The specimens referred to impressed me as being hybrids, and I feel confident that farther investigation will corroborate my opinion that species of *Haliotis* will occasionally cross. (Proceedings of the California Academy of Sciences, Vol. iii, p. 361.)

of the sea-water to the respiratory organs, analogous to the single vertical and nearly central hole in the shell of Fissurella. The holes in Haliotis are placed in a row nearly equidistant from centre to centre, upon the left side of the shell, parallel with the columellar lip, and being required only in that part of the shell which covers the branchial cavity, those nearest the apex are closed or grow up as the animal advances in growth. The holes furnish a passage for slender tentacular filaments which the animal can protrude at pleasure; the hole or notch for the passage of the anal siphon is situated at the posterior margin of the shell. The animal of Haliotis, according to P. P. Carpenter, "has two gills and two auricles, instead of one, as in the top-shells." Its head is blunt and terminates in a short muzzle, with two subulate tentacles and two stout eye peduncles at their bases. Upon the upper extremity of the foot it has a rudimentary operculigerous lobe, but no operculum. The foot is very large, rounded at the ends and fringed with thread-like tentaculæ, which, when the animal is protruded from the shell, below the surface of the water, are gently swayed with a somewhat vibratory motion. "The muscular attachment, instead of being horseshoe shaped as in ordinary univalves, is round and central, as in the oyster." (Carpenter.)

In adult shells in many of the species, the roughened portion of the interior indicates the area of the muscular attachment, while in young specimens the impression of the muscle is not shown.

The Haliotides are sedentary in their habits, as one would suppose, being both vegetarians and conservatives, and though capable of locomotion, they move but little and quite slowly; their structure, as seen in the powerful muscular foot, shows it is made for adhesion. They attach themselves to the rocks with the greatest tenacity, and I have often found it exceedingly difficult to remove them, though using a stout trowel, of a shape similar to the kind used by bricklayers.

The animal of Haliotis is exceedingly tenacious of life. I have frequently removed it from the shell by means of a sharp knife, and by throwing it, minus the shell, back into the water, it would at once descend and place itself in its normal position upon a rock, to which it would adhere with apparently as much tenacity as before it was deprived of its shelly covering.

"The brilliant and highly colored interior of these shells producing sometimes an iridescent effect, has been attributed by Sir David Brewster, Dr. Carpenter, and others, to minute striæ, or grooves, on the surface of the nacre, which alternate with others of animal membrane. The color is produced by the nature of the laminæ, which decompose the light in consequence of the interference caused by the reflection from two sides of each film, as may be seen in soap-bubbles. The nacreous laminæ, when magnified, indicate a minute cellular structure. The cells are of a long oval form, and their short diameter is not above $\frac{1}{3500}$ of an inch." (Jeffreys.) The animal of Haliotis is mentioned by Athenæus as being exceedingly nutritious but indigestible. "The maritime negroes of Senegal esteemed one species a great delicacy. . . . *H. tuberculata* is habitually eaten by the poor in the north of France and our Channel Isles, where it is occasionally cooked and served at the tables of the rich. It requires a good deal of beating and stewing to make it tender." (Jeffreys.)

In New Zealand the animal of *H. iris* is eaten by the natives, and is called "Mutton-fish." Another species is eaten in Japan. In California the animals of the two most abundant species, *H. rufescens* and *H. Cracherodii*, are frequently eaten by the Americans residing along the coast, and are a common article of food with the Chinese, who collect them in large quantities at Monterey, and other favorable localities north and south of that place, remove the animals from the shells, and dry the former for future use or for export to their native country.

The shells are also shipped from San Francisco to China and Europe in considerable quantities. In the former country they are used for inlaying in connection with the lacquer-work for which the Chinese are so famous, while in Europe they are used in the arts, and many are polished and treated with acid, to be returned to the United States and sold for card receivers or ornamental objects.

Their beauty has not escaped the eye of the savage, as pieces of the shells are worked into a variety of forms and worn to ornament the person, by the Indians of north-west America. They are also esteemed by the Indians living in the interior of the continent. My friend, Dr. Edward Palmer, recently informed me that when he was in the Indian Territory he saw a horse purchased with an *Abalone* shell. They are still held in esteem, but are not so highly prized as formerly.

Jeffreys says that in some parts of Guernsey the *ormer* was used for the purpose of frightening the small birds from the standing corn; three or four shells are strung loosely together and suspended from the top of a pole, so as to make a clatter when moved by the wind. Formerly they were used there to ornament the plastered exteriors of cottages, the plaster being studded with them.

In some places in California I have seen the shells of *Haliotis rufescens* suspended beside a sink, or placed upon a toilet-stand for holding the soap. They are quite convenient to the collector for holding or carrying smaller specimens in while searching along the shore, a purpose for which I have frequently used them. Sometimes the naturalist is well repaid by the examination of the back of large specimens of the roughly sculptured species; for, besides the miniature forest of marine vegetation, corallines, algæ, etc., which furnish an abiding place for diatoms and other minute forms, in the crevices of the shell can be found numerous small species of mollusca that would otherwise be seldom obtained.

The value of the exports of the Haliotis or Abalone shells from San Francisco was, in the year 1866, $14,440, being 1697 sacks, each of two bushels capacity; and in the year 1867 the export had increased to 3713 sacks, worth $36,090.

Jeffreys, in remarking upon the sale of the European species, *H. tuberculata*, says that the importation into England of the *Meleagrinæ*, or true mother-of-pearl shells, from the South Seas, has interfered with the sale of the "ormer" at Guernsey, although he was informed that one merchant . . . purchased from four to nine tons annually, paying seven shillings and sixpence per hundred weight, equal to about thirty-seven and one-half dollars per ton, American gold.

The geographical distribution of the Haliotides is widely extended; it is remarkable however that not a single species is found upon either coast of South America, or upon the east coast of North America, while no less than five or six species* are found on the west coast of North America, between the Gulf of California, northerly to, and including a part of Alaska.

Species are also found in Japan, China, Australia, New Zealand, Tasmania, and many of the smaller islands of the Indo-Pacific waters; the Canary Islands, Africa at the Cape of Good Hope, and the Atlantic Coast of Europe.

The length of this paper prevents my treating at this time of the uses made of the Haliotis shells in the arts by civilized peoples, or the purposes to which they are applied by the ruder races of mankind.

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*Of these five or six species, *H. splendens* Reeve, is found at San Diego and the islands off the coast; *H. corrugata* Gray, Santa Barbara to San Diego and Catalina Island; *H. rufescens* Swainson, from Mendocino County, southerly, to San Nicholas Island, *H. Kamtschatkana* Jonas, from Monterey, northerly to Alaska, also in Japan. *H. Cracherodii* Leach, from the Farallone Islands off the entrance to San Francisco Bay, southerly to San Diego; and *H. Californiensis* Swainson, a doubtful species, upon the islands and the outer coast of Lower California. This latter form, which is regarded by many as a *variety* of *H. Cracherodii*, is quite rare, though I have several specimens in my collection. *H. Cracherodii* has from five to eight holes, while the other has from eight to thirteen.

A CHAPTER ON CUTTLE-FISHES.*

BY LUCIE L. HARTT.

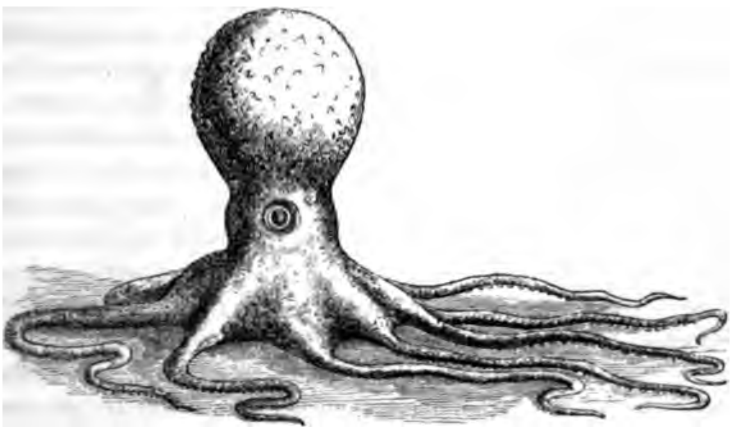

Fig. 45.

It was during my first visit to Brazil, that one day, while busily engaged in examining a reef at a little town on the coast called Guarapary, my eye fell on an object in a shallow tide-pool, packed away in the crevice of the reef, which excited my curiosity. I could see nothing but a pair of very bright eyes; but, concluding that the eyes had an owner, I determined very rashly to secure him. I had been handling corals and seemed to have forgotten that all the inhabitants of the sea are not harmless. I put my hand down very quietly so as not to ruffle the water, when, suddenly, to my surprise, it was seized with a pressure far too ardent to be agreeable, and I was held fast. I tugged hard to get away, but this uncivil individual, whoever he was, evidently had as strong a hold on the rocks as he had on my hand, and was not easily to be persuaded to let go of either. At last, however, he became convinced that he must choose between

*The facts herein narrated were drawn from one of my note-books, and were an actual experience of mine. The story is told in the first person for obvious reasons.—C. F. Hartt.

The value of the exports of the Haliotis or Abalone shells from San Francisco was, in the year 1866, $14,440, being 1697 sacks, each of two bushels capacity; and in the year 1867 the export had increased to 3713 sacks, worth $36,090.

Jeffreys, in remarking upon the sale of the European species, *H. tuberculata*, says that the importation into England of the *Meleagrinæ*, or true mother-of-pearl shells, from the South Seas, has interfered with the sale of the "ormer" at Guernsey, although he was informed that one merchant . . . purchased from four to nine tons annually, paying seven shillings and sixpence per hundred weight, equal to about thirty-seven and one-half dollars per ton, American gold.

The geographical distribution of the Haliotides is widely extended; it is remarkable however that not a single species is found upon either coast of South America, or upon the east coast of North America, while no less than five or six species* are found on the west coast of North America, between the Gulf of California, northerly to, and including a part of Alaska.

Species are also found in Japan, China, Australia, New Zealand, Tasmania, and many of the smaller islands of the Indo-Pacific waters; the Canary Islands, Africa at the Cape of Good Hope, and the Atlantic Coast of Europe.

The length of this paper prevents my treating at this time of the uses made of the Haliotis shells in the arts by civilized peoples, or the purposes to which they are applied by the ruder races of mankind.

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* Of these five or six species, *H. splendens* Reeve, is found at San Diego and the islands off the coast; *H. corrugata* Gray, Santa Barbara to San Diego and Catalina Island; *H. rufescens* Swainson, from Mendocino County, southerly, to San Nicholas Island; *H. Kamtschatkana* Jonas, from Monterey, northerly to Alaska, also in Japan. *H. Cracherodii* Leach, from the Farallone Islands off the entrance to San Francisco Bay, southerly to San Diego; and *H. Californiensis* Swainson, a doubtful species, upon the islands and the outer coast, of Lower California. This latter form, which is regarded by many as a *variety* of *H. Cracherodii*, is quite rare, though I have several specimens in my collection. *H. Cracherodii* has from five to eight holes, while the other has from eight to thirteen.

A CHAPTER ON CUTTLE-FISHES.*

BY LUCIE L. HARTT.

Fig. 45.

IT was during my first visit to Brazil, that one day, while busily engaged in examining a reef at a little town on the coast called Guarapary, my eye fell on an object in a shallow tide-pool, packed away in the crevice of the reef, which excited my curiosity. I could see nothing but a pair of very bright eyes; but, concluding that the eyes had an owner, I determined very rashly to secure him. I had been handling corals and seemed to have forgotten that all the inhabitants of the sea are not harmless. I put my hand down very quietly so as not to ruffle the water, when, suddenly, to my surprise, it was seized with a pressure far too ardent to be agreeable, and I was held fast. I tugged hard to get away, but this uncivil individual, whoever he was, evidently had as strong a hold on the rocks as he had on my hand, and was not easily to be persuaded to let go of either. At last, however, he became convinced that he must choose between

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us, and so let go his hold upon the rocks, and I found clinging to my right hand, by his long arms, a large octopod cuttle-fish, resembling the one figured at the head of this article, and I began to suspect that I had caught a Tartar. His long arms were wound around my hand, and these arms, by the way, were covered with rows of suckers, somewhat like those with which boys lift stones, and escape from them was almost impossible. I knew that this fellow's sucking propensities were not his worst ones, for these cuttle-fishes are furnished with sharp jaws, and they know how to use them too, so I attempted to get rid of him. But the rascal, disengaging one slimy arm, wound it about my left hand also, and I was a helpless prisoner. In vain I struggled to free myself,—he only clasped me the tighter. In vain I shouted to my companion,—he had wandered out of hearing. I was momentarily expecting to be bitten, when the "*bicho*" suddenly changed his mind. I was never able to discover whether he was smitten with remorse and retired with amiable intentions, or whether he only yielded to the force of circumstances. At any rate he suddenly relinquished his hold upon my hands and dropped to the sand. Then raising himself on his long limsy arms, he stalked away towards the water, making such a comical figure, that in spite of my fright I indulged in a hearty laugh. He looked like a huge and a very tipsy spider, staggering away on his exceedingly long legs.

The cuttle-fish belongs to the Mollusks, a branch of the animal kingdom distinguished for its members being built on the plan of a sac, and to which Mr. Hyatt has applied the more appropriate name of *Saccata*. The cuttle-fishes are distinguished from all the other Mollusks, such as snails, clams, etc., by having a large head, a pair of large eyes, and a mouth furnished with a pair of jaws, around which are arranged in a circle, eight or ten arms furnished with suckers.

In the common cuttle-fish or squid of our coast, the body, which is long and narrow, is wrapped in a muscular cloak

or mantle, like a bag fitting tightly to the back but loose in front. It is closed up to the neck, where it is open like a loosely fitting overcoat, buttoned up to the throat. Attached to its throat, by the middle, is a short tube open at both ends. This tube, or siphon as it is called, is fastened to its throat, and can be moved about in any direction.

The animal breathes by means of gills, which are attached to the front of the body inside the cloak and look like the ruffles of a shirt bosom. By means of these gills the air contained in the water is breathed, and they answer the same purpose for the cuttle-fish that our lungs do for us.

In order to swim, the animal swells out the cloak in front so that the water flows in between it and the body. Then it closes the cloak tightly about the neck so that the only way the water can get out is through the siphon. Then it contracts very forcibly its coat, which, it must be remembered, is a part of the animal, and the water is driven out in a jet from the siphon under the throat, and the body is propelled in the opposite direction; that is, backward like a rocket through the water. This siphon is flexible like a water-hose, and can be bent so as to direct the stream not only forward, but sidewise and backward, so that the animal can move in almost any direction, or turn somersets with perfect ease, and so rapidly do some cuttle-fishes swim that they are able to make long leaps out of the water. Usually, however, the animal swims backward, with its long arms trailing behind. Our common cuttle-fish of this coast has, in addition to its eight arms, two long slender tentacles which may be withdrawn into the body. The tail is pointed, and furnished with a fin on each side.

The Octopods, to which the Brazilian cuttle-fish (Fig. 45) belongs, have round purse-like bodies, and eight arms united at the base with a web, and they swim by opening and shutting their arms like an umbrella; in this mode of swimming they resemble the jelly-fishes.

The paper Nautilus is nothing in the world but a female

cuttle-fish that builds a shell. There was a very pretty story told of her habits, by Aristotle, the old Greek naturalist, which every one believed until quite lately. He said that she rode on the top of the waves, seated in her boat-like shell, and spreading her broad arms to the winds for sails. But unfortunately the story has no foundation in fact. She either crawls about on the bottom of the sea, or swims quite like any other cuttle-fish, shell foremost, only occasionally coming to the surface. Strangely enough she holds the two broad hand-like extremities of the arms against her body, and it is the inside of these arms that secrete the paper-like shell, which is only a sort of cradle for her eggs. Not so with the pearly Nautilus, which is furnished with a beautiful, coiled up, pearly shell, formed on the outside of the animal. This shell is divided into numerous chambers, and the animal living in the outer one builds a partition across the back part of it as the shell grows.

Cuttle-fishes are sometimes used for food by the Brazilians, and different species may be seen in the markets, where one frequently finds them still alive. Sometimes, as he stoops to examine one, its body is suddenly suffused with a deep pinkish glow. Before he has time to recover from his surprise this color fades, and a beautiful blue takes its place as rapidly as a blush sometimes suffuses a delicate cheek. The blue, perhaps, is succeeded by a green, and then the whole body becomes pink again. One can hardly conceive anything more beautiful than this rapid play of colors, which is produced by the successive distention of sets of little sacks containing fluids of different colors, which are situated under the skin.

The cuttle-fish is also furnished with a bag containing an inky fluid, which, when the animal is attacked or pursued, it ejects into the water, thus completely blinding its adversary and effectually covering its retreat. It is from this fluid that the color *sepia* is made. Beside carrying an ink-bottle, some species of cuttle-fish are provided with a long,

delicate, horny pen, which forms a sort of stiffener to the back. In some species the pen is hard, thick and broad, and the cuttle-fish bone of commerce is a pen of this kind. The species found in our waters is very small, and not at all dangerous, being barely large enough to draw blood from the hand; but in the tropical seas they are very large, powerful and dangerous.

The cuttle-fish is the original of Victor Hugo's devil-fish, so vividly described in the "Toilers of the Sea." If the devil-fish were a beneficent creation, I should be sorry to destroy your faith in it; but as it is, I believe it will be rather a relief than otherwise to know that in some important respects, Victor Hugo's story of it is a fable. The Kraken was a mythical cuttle-fish of fabulous size.

SOMETHING ABOUT CRABS.

BY REV. SAMUEL LOCKWOOD.

WELL do we remember our boyish sport catching crabs. A stout string, a piece of fresh offal, a hand-net, and another boy with us and a good place on an anchored raft,—then for fun. The meat was dropped to the bottom; the cancerous varmint took hold, and kept hold; then we slowly drew the bait up, and, when within a few inches of the surface, chum adroitly slipped the scoop-net under. But would'nt "spider-legs" run up the sides of the net! It needed all our alertness to secure the prey. What a luxury those crab dinners! But what was that pleasure compared to the delight of our riper years, when we made the acquaintance of the inner life of these entertaining people, Lupa, Libinia, Pagurus, and others. We have spent many health-giving days with them at the "watering-places," and many hours in the drawing-

room, they affording us abundant refined entertainment in return for our aquarian hospitality.

A wonderful thing, so considered, is told in the court journals of the Empress Eugenie on public days; how that she appears in sumptuous array, and then will disappear, and in an incredibly short space of time reappear in an entire and elaborate change of dress. Her admirers gaze as if it were magical. But suspended from the ceiling of the boudoir, garment within garment is the awaiting suit. The Empress has but to doff, and then to don, while many zealous and tasteful fingers are busy all around—a little readjustment of her coiffure, and presto! all is done! and the changed creature is again among her astonished admirers. But suppose an old knight could put off as one unbroken suit his iron encasement, with not so much as the unlacing of his gear, and then on the nonce should appear in a new suit of mail of high finish and faultless fit,—would not this man in iron beat my dame in silk? And yet the knightly and the queenly feat are nowhere when we instance the exuviation and redressing of Mrs. Lupa dicantha, the common edible crab. During the first year of its life, this crab puts off its hard shelly encasing several times. That is to say, when a youngster, it requires several new suits. After the first year until it gains the fully matured age, an annual suit suffices. When fully grown, its case is permanent. We knew some years ago an old crabber, wholly illiterate, but whose intelligence was above the average. He had "crabbed" for the market many years. Often when supplying our family with fish, has he been closely questioned by us about the crabs, and always have his statements tallied one with another. In our notes occur the following in the fisherman's own words:—"I hev ketched soft crabs for market many year. The crab sheds every year, chiefly in early summer. At that time the he one is mighty kind to his mate. When she shows signs of shedding, the he one comes along and gits on the she one's back, quite tenderly-like, and entirely

protects her from all enemies, whether of fishes, or of their own kind. She is now getting ready to shed, and is called a *shedder*. Soon the back begins to burst nigh to the tail. She is then called a *buster*. The he one is then very anxious to find a good place for her, either by digging a hole in the sand or mud, or else looking up a good cover under some sea-weed. Here he brings her, all the time hovering nigh, and doing battle for her if anything comes along. She now —and it only takes a few minutes—withdraws from the old shell. And she comes out perfect, every part, even to the inside of the hairs, eyes and long feelers, almost like the whiskers of a cat. At the first tide she is *fat*, and the shell is soft, just like a thin skin. She is then called a *soft shell*, and it 's the first-tiders that bring the high price. At the second tide she is perfectly watery and transparent, and is called a *buckler*; but she is not worth much then. At the third tide she is again a *hard shell*, just as she always was, only bigger."

"Have you seen all this with your own eyes?" we asked.

"Lor, sir, yes, hundreds and hundreds of times."

For the sake of contrast with these observations of an illiterate man, let us give the gist of an entertaining passage from Gosse:

"Peering into a hole I saw a fine large crab. Though he made vigorous efforts to hold fast to the angles of his cave, I pulled him out, and carried him home. I noticed that there came out with him the claw of a crab of a similar size, but quite soft, which I supposed might have been carried in there by my gentleman to eat, or accidentally washed in. After I had got him out—it was a male—I looked in and saw another at the bottom of the hole. Arrived at home I discovered that I had left my pocket-knife at the mouth of the crab-hole. I returned, the crab had not moved. I drew it out, as I had done the others. But lo! it was a soft crab, the shell being of the consistence of wet parchment. It was a female, too, without any sign of spawn, and had lost one

claw. I carefully put the helpless creature into the hole again.

"What then are we to infer from this association? Do the common crabs live in pairs? And does one keep guard at the mouth of the cavern while its consort is undergoing its change of skin? If this is the case it is a pretty trait of cancrine sagacity, and one not unworthy of their acute instinct and sagacity in other respects. I have no doubt that the claw of its mate was unintentionally torn off in its efforts to grasp some hold when resisting my tugs in dragging him out."

See, then, the beautiful parallel—the simple remark of the illiterate observer, and the learned queries of the practised naturalist.

Not a little interest have we felt in an individual known to us as the "Sea Spider," or "Spider Crab." Wishing to make a good introduction for our friend, and as some who have no desire to know Mrs. John Smith might perhaps feel flattered if presented to the lady of Johannes Smythius, Esq., so we would say, that by Spider Crab, we mean no less a personage than Libinia canaliculata. She is regarded by some as a pest on the oyster beds, and is accused of eating the oyster spat or young. How much truth there may be in this is to us unknown. At any rate we have never seen the slightest evidence to sustain the charge. We have regarded her appetencies as omnivorous. But, as our acquaintance has been chiefly in the drawing-room, it may be that there her tastes became fastidious. One peculiarity of habit is all that we have time to describe. The Spider Crab will grow as large as one's hand. A pet that we had a long time was only an inch wide across the shell. We must tell the truth, and say that her aspect was not the most tidy or even cleanly. Her back looked much as if she had taken a glue bath, and then, like a chicken, a dust bath afterwards. Through this agglutinous coat sundry small sharp spines appear. She does not covet society, and so withdraws to

a cozy grotto, whose walls are green with the tender little fronds of the young sea-lettuce, the *Ulva latissima*, and the delicately crimped ribbon leaves of the *Enteromorpha intestinalis*. It did not please us much to see the pert Libinia, with her nippers like little shears, snipping off the velvet lining of the cave. Being indulgent we did not interfere, but left her to her own enjoyment. When we returned, out came Mrs. Libinia in full dress to greet us. On every spine of her uncouth carapace was a green ribbon,—all gracefully waving as she strutted in the open grounds of the establishment. What a sight to look at! And what a lesson in animal psychology! What was the mental process? Was it a device,—"a moving grove," like Macduff's, in order to deceive its prey? If so, what intelligence! Or, was it her vanity? Done just for the looks of the thing! If so, what inexplicable caprice! This fact we have seen; and an intelligent aquarist friend assures us he has seen it a number of times. The English naturalists tell the same of their Sea Spider (*Maia squinado*). And one of them (Harper) even makes us almost believe that when this humor is upon it, it will even dance, or at least exercise a certain rythmic movement at the sound of music. Query; has it that hardihood when it hears the refrain:

> "They hang both men and women there
> For the wearing o' the green!"

If so, Madame Maia, may your gayety never be your ruin.

We can only introduce one more of these curious little creatures, and that must be the little Hermit Crab, the *Pagurus longicarpus*, so common on our shores. Though a recluse, for he lives in a vacated sea-shell all alone, yet of hermit gravity he has none. In fact he is constitutionally a funny fellow. This crab has his two hands, or claws, greatly larger than the others; and of these, the right one is much stouter than the left. The next three pairs of claws behind are tipped with simple hooks, which having a considerable leverage power, are really efficient grapnels with

which to pull himself along when he travels, carrying his house on his back; while the claws of the fifth or last pair are very diminutive, and yet have a beautiful structural relation, as they enable the animal to perform the small amount of movement needed by the body inside the shell. Behind all these limbs the body is entirely naked, hence the necessity of an empty sea-shell with which to cover it. On the extreme end of the naked body is an apparatus for taking firm hold of the little column in the upper part of the shell.

There is a queer monkey-like drollery in the looks of the Little Hermit. We had in our aquarium one of rather large size, and which occupied a shell of the required capacity. Of this specimen we were very proud. The shell on its upper part was ashen white, with a fine colony of Hydractinia, like tiny sea-daisies. And mystic beings they were; for by that strange law of parthenogenesis, they were the great-grandparents of those huge and splendid creatures, the gorgeous Acalephs! We had also a little Hermit in a small *Nassa obsoleta.* And what about this young scapegrace, whom we soon almost wished obsolete? On he came, and climbed right up into this pretty parterre, and having secured himself with his grapnels on top of his neighbor's house, most deliberately, now with the right claw, and now with the left, he pulled off my weesome pets, stowing them into his ugly mug with a movement so regular, that it seemed almost rythmical, and yet so cruelly comical, that it made me most laughably mad.

But the Hermit grows, while the sea-shell which he occupies does not. Hence like many bipeds, he has his "first of May." So he goes house-hunting. This must be understood literally. He finds a shell. Will it do? First then is it really "to let." He will "inquire within." This he does, if not the most courteously, very feelingly. Satisfied on this point, the next question is, will the house suit. He turns it over, then turns it around. You see the weight of

one's house is quite an item in the reckoning to him who has to carry it on his back. One inspection more. How is it inside? Is it entirely empty, and is it of the right size? Up goes one of the long slender limbs of the second pair, and the interior is thoroughly explored. All right! Just the house he is after. His mind is now made up to move. Look at him! Quick! or you'll miss it! Out comes the body from the old house, and pop it goes into the new one! The resolution to move was taken, the surrender of the old house was made, and the occupancy of the new was effected, and all within a fraction of a second of time.

Sometimes this matter goes on less pleasantly. Two house-hunters may find the same tenement. Should both desire it then comes the tug of war. Live together they neither can, nor will. The affair is settled by a battle, in which the stronger usually proves his claim right by the Carlyleian logic and morals, viz., might. Quite often from these encounters a terrible mutilation results.

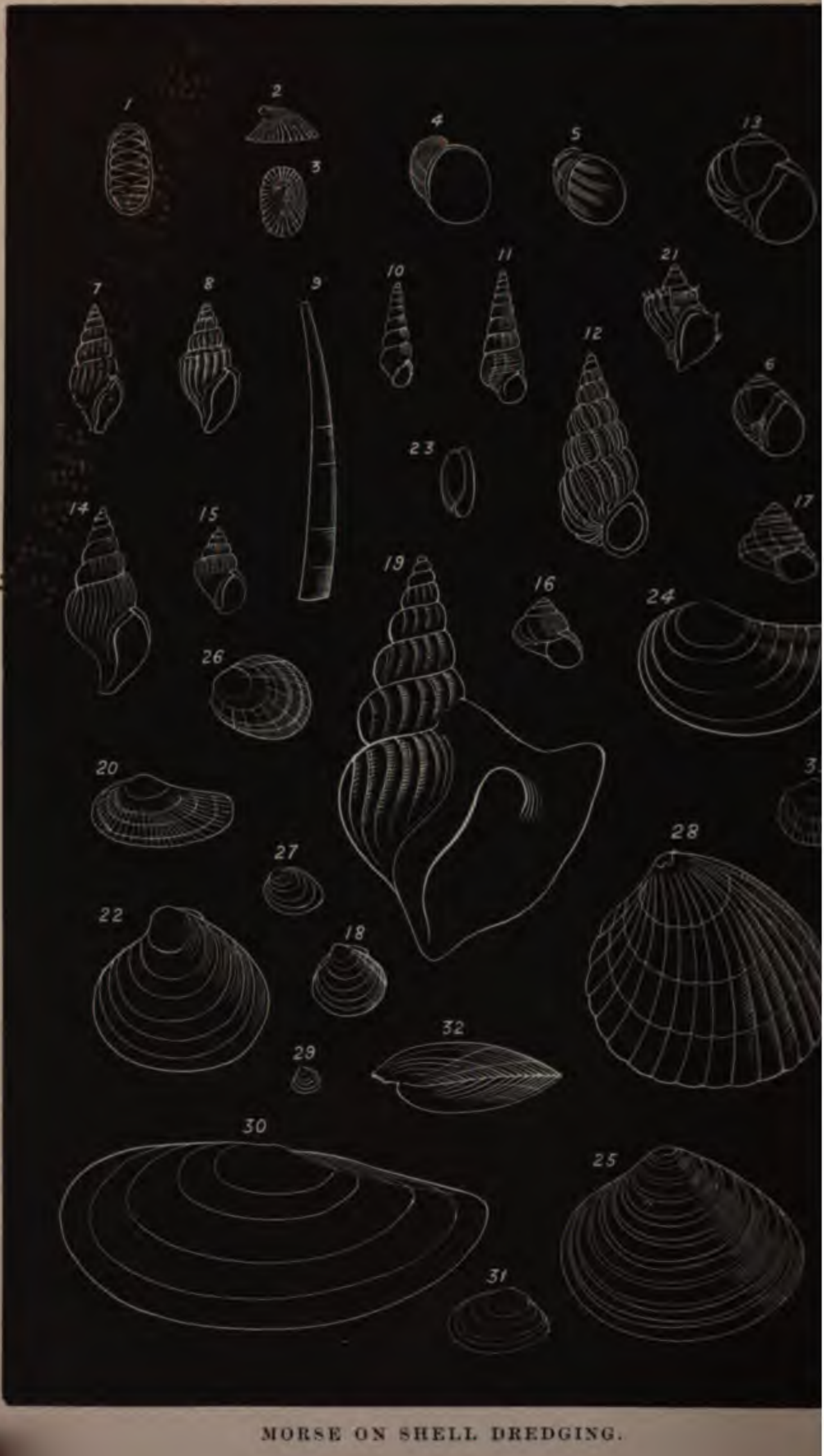
To us it is a sad sight to see the Little Hermit, when "his time has come," and he knows it; that is when Pagurus must die. However droll his career may have been, the Little Hermit is grave then. And what a strange fact it is! Who can explain it? The poor little fellow comes out of his house to die! Yes, in order to die. To us humans home is the only right place to die in. But for Pagurus home has no attraction at this solemn time. Is it because he feels encoffined that he comes out, that "his feet may be in a wide place?" Poor fellow, with a sad look and melancholy movement, he of his own will quits the house for which he fought so well. Those antennæ, or feelers, that often stood out so provokingly, and were so often poked into everybody's business, now in a feeling manner lie prone and harmless. The eyes have lost their pertness. There lies the houseless Hermit on that mossy rock, stone dead!

The human side of these lowly creatures, as unfolded by close observation of their habits, is much better understood

in England than with us. Our naturalists seem to be chiefly occupied with the study of structure. When their habits are better understood we shall doubtless learn something which as yet are only known of foreign species. One of these we would instance in closing.

The Hermit, as its name imparts, loves solitude so far as the occupancy of its shell is concerned. There is an English species, Prideaux' Hermit, that seems to take Patrick's view of seclusion: "Its very nice to be all alone by one's self, especially if one has his sweetheart with him." So this Hermit believes in having for a companion the dressy Cloaklet Actinia; nor will he live without her. And if form and color be considered, remarkably recherche is this Sea-anemone. Her form adapts her to surround the shell mouth like a frill, while her disk is of waxy white, and the rest is elegantly varied with reddish-brown, rose-purple and scarlet. This gorgeous creature adheres around the entrance of the Hermit's shell, so that his lookout is from a mantel richer than any field of cloth-of-gold. But when the Hermit has outgrown his house, and moving-day comes, does he leave his beautiful though helpless companion? No, a better gallantry is his. He causes her to loose her long adherence to the shell's mouth, and to cleave to the underside of his thorax. In this way he carries her with him to their new home. And what then? Most tenderly he places her in position, and holds her there until a good adhesion of the base takes effect, when she with her protector, is snugly domiciled again. These facts are given in pleasant detail by Gosse, from whom we quote the following:

"Is there not here much more than what our modern physiologists are prone to call automatic movements, the results of reflex sensorial action? The more I study the lower animals, the more firmly am I persuaded of the existence in them of psychical faculties, such as consciousness, intelligence, will and choice! and *that*, even in those forms in which as yet no nervous centers have been detected."



MORSE ON SHELL DREDGING.

Thus [illegible]
naturalists [illegible]
that the [illegible]
grabbed.

A STRONG [illegible]
among the import[illegible]
who has pulle[illegible]
fathoms, the [illegible]
if this act has [illegible]
niments of [illegible]
fingers while [illegible]
who are seas[illegible]

In dredging [illegible]
attended with the [illegible]
we will not [illegible]
of the dredge [illegible]
treasures of [illegible]
other way. [illegible]
are obtained [illegible]
other fishes [illegible]
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[illegible] stomach. [illegible]
the objects in [illegible]
them alive [illegible]
about and [illegible]

A dredge [illegible]
across the mouth [illegible]
[illegible] inch in width [illegible]
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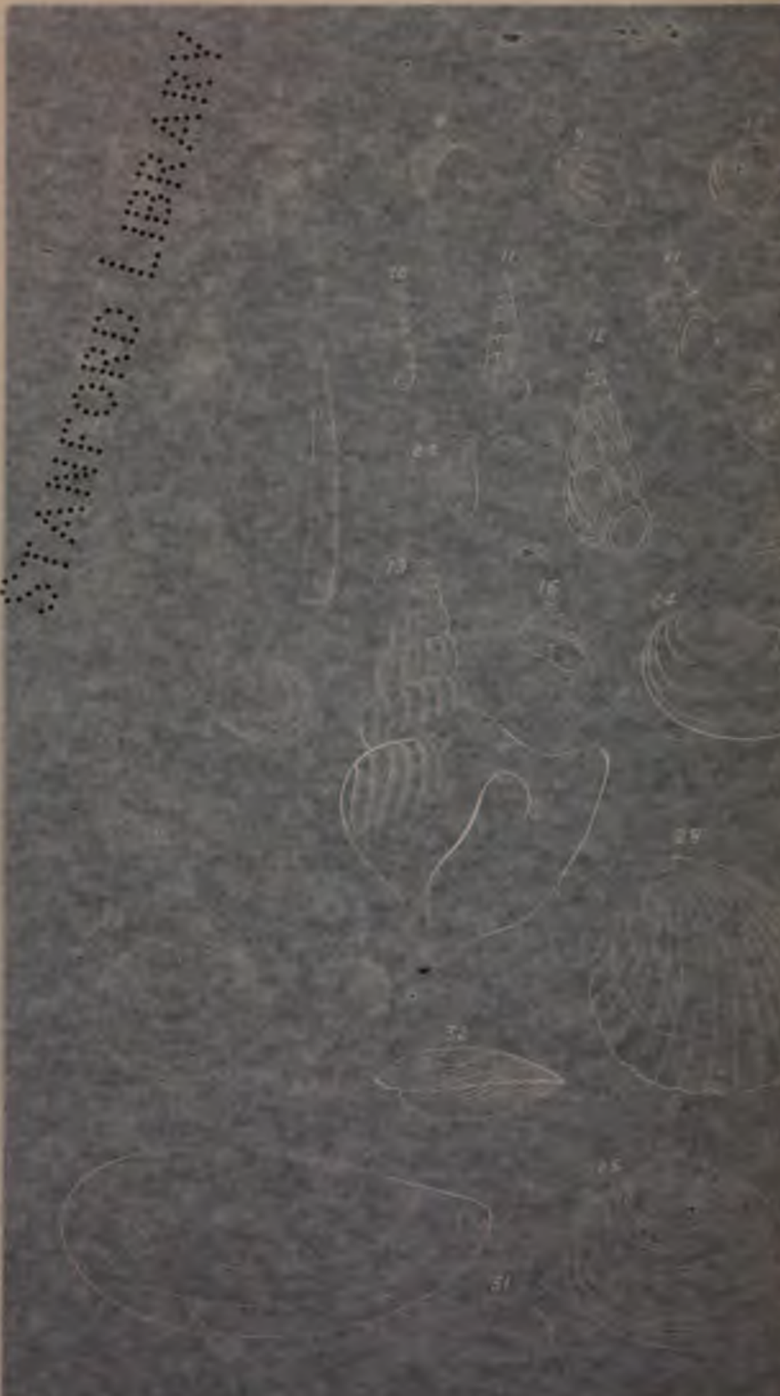


MORSE ON SHELL DREDGING.

Thus ends our history of these cancrine crustacea, as the naturalists call them, namely, the crabs. Our hope has been that the reader does not regard it as crusty, cancer-ous, or crabbed.

SHELL DREDGING.

BY EDWARD S. MORSE.

A STRONG arm and an immunity from sea-sickness are among the important requisites of a good dredger. To one who has pulled up a well-filled dredge from fifteen or twenty fathoms, the necessity of a strong arm is obvious, especially if this act has been attended with the not unusual accompaniments of a rough sea, and a cold breeze which stiffens the fingers while grasping the wet rope. One can only pity those who are sea-sick, for they are helpless.

In dredging one oftentimes enjoys the keenest pleasure, attended with the greatest bodily discomforts. The miseries we will not mention. The delights come when the contents of the dredge are sifted, and there lies before you the only treasures of the deep; treasures that can be obtained in no other way. It is true that many deep-water species of shells are obtained from the stomachs of the haddock, cod and other fishes, particularly from the haddock, which seems to live principally on mollusks. Specimens procured from this source are generally impaired by the action of the juices of the stomach. The beauty of dredging consists in getting the objects in their living condition; and then you may keep them alive in sea-water for some time, and see them crawl about and watch their singular ways.

A dredge should not be too large, perhaps sixteen inches across the mouth. The frame is made of a flat bar of iron, an inch in width and an eighth of an inch in thickness, one edge of which should be hammered sharp and turned out, to

form the scraping edge, as represented in the cut at the close of this article. The other edge must be drilled with small holes an inch apart, to which a stout cloth bag is to be sewed. It is well to have the sides of the bag made of netting so that the water may drain from it quickly. The iron shanks are to be fastened to the dredge, as shown in the figure. A dredge of this shape, however it falls, when drawn slowly along, is sure to scrape up the mud. It is well to have for a rope a good strong one of manila-hemp, and this should be well secured to the dredge. It is necessary to have the length of the rope more than twice the depth you intend to dredge in; thus, if you were to dredge in ten fathoms, you should be provided with at least twenty-five fathoms of rope, as it is necessary to give the dredge sufficient "slack" in order that it may drag properly. Should the dredge meet with any obstacle, it can generally be liberated by retracing the track passed over, dragging the dredge in an opposite direction. It is well to add that a row-boat is best to dredge from, that is for light dredges, as you want to move very slowly through the water. A fine sieve is necessary to sift out the mud, a few pails in which to empty the contents of the dredge, and some large-mouthed vials in which to save the animals alive.

After a little experience in dredging you will notice that certain species live on certain "bottoms." Thus, if your dredge comes up filled with mud, you must sift the mud carefully, and from it you will find certain forms different from those you may dredge from a sandy bottom. It is well to examine your sieve often, that the smaller species may not be washed away. Sometimes the dredge will come up filled with stones; do not throw these away in disgust, but examine each stone carefully, and clinging to them you will find several species of shells found in no other way. One species, called *Cemoria Noachina* (Pl. 4, figs. 2, 3), is like a very small limpet, with a little hole in its top from which radiate little ribs, giving the shell a very elegant appearance

under the magnifier. Then there are certain species of shells (Chiton, Pl. 4, fig. 1) which cling to the stones, limpet-like, but instead of having a shell of one piece covering their back, the shell is composed of eight transverse pieces, one lapping over the other. When detached from the rock they often roll up like a pill-bug. On the eastern coast of Maine there is one large species which can be taken from the rocks at low-water mark. The species dredged in Massachusetts Bay are generally small; one or two of them are brightly colored with shades of red.

Two other species called Velutina (Pl. 4, figs. 4, 5) are often found adhering to the rocks brought up in this manner. By far the most beautiful and interesting animals are contained in the little cells which often cover the rocks from deep water. They are arranged in little patches like mats, some species making a perfectly circular figure, others covering the rocks in irregular patches. These belong to the lowest group of mollusks, and are called Polyzoa. Under the microscope the mass is seen composed of little cells, arranged like the stones in a pavement. Each one of these cells has a little opening protected by a small lid, which opens to allow the animal within to protrude a tuft of minute feelers. It would require too long a time to show the affinity of these animals to the clam and oyster, yet they are among the lowest forms of this group. There are many species on our coast, some of which have been described as new, others are similar to British species.

We figure on Plate 4 several species of shells one is likely to dredge on our New England coast, though representing but a small portion of the species that may be found, and we may mention here, with propriety, that the State of Massachusetts—with that liberality that has always characterized the acts of its legislature—has now in preparation a new edition of "Gould's Report on the Invertebrate animals of the State." This book, when published, will contain carefully engraved figures of all the species of shells found

within its limits, and the marine species alone (containing all the animals that belong to the branch of mollusca, though many have no hard calcareous shells) number three hundred and sixteen. Several of these are cuttle-fishes, and there are many mollusks which have no shells, the branchiæ or gills being naked; hence they are called Nudibranchia. They comprise the most beautiful animals in the branch of Mollusca, for certain species are very brilliantly colored.

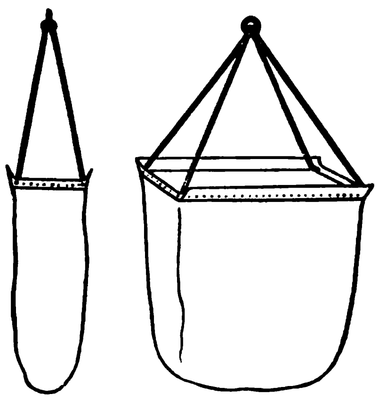
The species figured on the plate are among the few that the collector is likely to bring up while dredging in our bays and inlets, in depths of from ten to fifteen fathoms. Should he be ambitious to throw his dredge into depths of fifty or one hundred fathoms, many other species will be secured that he could not get in water of less depth.

The outlines given will be found sufficiently accurate to enable the collector to identify the species represented. Fig. 1 represents *Chiton albus*; the shell is not quite half an inch in length; it is generally a dead white color. Figs. 4 and 5 represent *Velutina haliotoides* and *V. zonata*, the latter differing from the former in having a more solid shell, and in having the shell marked with bands of brown. Fig. 6 is the *Natica immaculata*, a pure white shell of the size represented; very common. Fig. 13 represents another species, *Natica clausa;* color from a white to a dark reddish brown. The little lid that closes the aperture of most marine shells is in this species white and shelly, and not of the horny consistency characterizing the opercula of most shells in our region. *Pandora trilineata* (Fig. 24) is easily distinguished by its white pearly color, and the manner in which the valves are pressed together. *Lyonsia hyalina* (Fig. 20) has a very fragile translucent shell covered with radiating wrinkles. *Thyasira Gouldii* (Fig. 18) has a delicate white shell, along one margin of which is a deep fold. The shell of *Astarte castanea* (Fig. 22) is quite solid, and chestnut-colored. It is found abundantly in Provincetown harbor at low water. *Astarte sulcata* (Fig. 25) is known by its strongly marked

concentric ridges. The color in young specimens is very light-brown; in old ones the shell is of a brownish olive color. *Cardita borealis* (Fig. 28) has a brownish shell with the ribs crenulated. *Cardium pinnulatum* (Fig. 33) has a dingy white shell, ornamented with about twenty-five ribs, each of which has a series of little scales. *Yoldia limatula* (Fig. 30) has a beautifully polished shell, of a light green color. The hinge is complicated by a number of long sharp teeth, so closely interlocked, that it is difficult to separate the valves without breaking them. *Tellina tenera* (Fig. 31) has a white iridescent shell. *Nucula tenuis* (Fig. 27) is smooth and green in color. *Nucula delphinodonta* (Fig. 29) is brownish green. All the Nuculas have the same peculiar hinge of numerous interlocking teeth. *Crenella glandula* (Fig. 26) has a brownish yellow shell, marked with minute radiating lines. *Terebratulina septentrionalis* (Fig. 32), though apparently related to the other bivalves, is widely different from them and belongs to another order; the shell is secured to the bottom, generally on stones, by a fleshy peduncle which passes through a hole in the upper valve. *Dentalium striolatum* (Fig. 9) has a shell like a long curved tapering tube. *Scalaria Grœnlandica* (Fig. 12) has a shell that looks more like a tropical species than a denizen of our cold northern waters. The shell is very attractive, with its turreted spire banded by prominent ribs. It is related to the foreign species, commonly called the "Wentle trap," which formerly brought fabulous prices among shell collectors. *Margarita undulata* (Fig. 16) is one of our most beautiful marine shells. The color of the shell when fresh is rose-red with a pearly lustre. Another species of this genus, *Margarita cinerea* (Fig. 17), is ashy white. There are several species on the coast, and all are so characteristic that they can be easily identified. *Cylichna alba* (Fig. 23) is bluish white. *Turritella erosa* (Fig. 11) has a pale brown shell, and *Odostomia producta* (Fig. 10) has a light brown-colored shell. *Bela harpularia* (Fig. 7) is brownish in color,

and *Bela turricula* (Fig. 8) is thin and pure white. *Tritonium pygmæum* (Fig. 14) is yellowish white. *Admete viridula* (Fig. 15) is white. *Trichotropis borealis* (Fig. 21) is yellowish in color. *Aporrhais occidentalis* (Fig. 19) is one of the most singular shells that we have. It is rare on our coast, but is common towards Newfoundland.

We must bear in mind that the species mentioned are a few among the many that most likely will be collected in dredging on our coast.



Dredge.

EXPLANATION OF PLATE IV.

Fig. 1. *Chiton albus* Linn.
Figs. 2, 3. *Cemoria noachina* Linn.*
Fig. 4. *Velutina haliotoides* Müll.
Fig. 5. *Velutina zonata* Gould.
Fig. 6. *Natica immaculata* Totten.
Fig. 7. *Bela harpularia* Couthouy.
Fig. 8. *Bela turricula* Mont.
Fig. 9. *Dentalium striolatum* Stimpson.
Fig. 10. *Odostomia producta* Adams.*
Fig. 11. *Turritella erosa* Couth.
Fig. 12. *Scalaria Grœnlandica* Perry.
Fig. 13. *Natica clausa* Sowerby.
Fig. 14. *Tritonium pygmæum* Gould.
Fig. 15. *Admete viridula* Fabr.
Fig. 16. *Margarita undulata* Sby.
Fig. 17. *Margarita cinerea* Couth.
Fig. 18. *Cryptodon Gouldii* Phil.*
Fig. 19. *Aporrhais occidentalis* Beck.
Fig. 20. *Lyonsia hyalina* Conrad.
Fig. 21. *Trichotropis borealis* Sby.
Fig. 22. *Astarte castanea* Say.
Fig. 23. *Cylichna alba* Brown.
Fig. 24. *Pandora trilineata* Say.
Fig. 25. *Astarte sulcata* Mont.
Fig. 26. *Crenella glandula* Tott.
Fig. 27. *Nucula tenuis* Mont.
Fig. 28. *Cardita borealis* Conrad.
Fig. 29. *Nucula delphinodonta* Mighels.
Fig. 30. *Yoldia limatula* Say.
Fig. 31. *Tellina tenera* Say.*
Fig. 32. *Terebratulina septentrionalis* Couth.
Fig. 33. *Cardium pinnulatum* Conrad.

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* Enlarged twice.

REVIEWS.

Review of Scandinavian Natural History Literature in 1867–8. By Dr. C. F. Lütken.—As an appendix to my former report I beg leave to insert a review of some Norwegian papers recently received, viz., the University programme of the University of Christiania, for 1868, by Prof. Sars, and the volume, for 1867, of the Proceedings of the Society of Science of the Norwegian Metropolis, the first named of which is of unusual scientific importance and interest.

Among the many valuable works with which Prof. Sars has enriched science, his last, "*Mémoires pour servir à la Connaissance des Crinoides vivants*," is certainly one of the most precious, and justly so from the great interest attached to this topic, partly from the great, one might say, rather painful, minuteness and care with which the author treats every detail of form and structure in the remarkable animal described. He has been successful enough to procure, through the exertions of his son, a great number (seventy-five specimens) of the remarkable small new stalked Sea-lily, discovered by the younger Sars in the abysses of Lofoten (68° north latitude), and now described under the name of *Rhizocrinus Lofotensis*. Four excellently engraved plates are devoted to the illustration of the elaborate description. The memoir is written entirely in French, and it will therefore, perhaps, be thought superfluous to give an abstract of it in this place, the more as it will be easily accessible through the liberality of the University of Christiania, to all societies, etc., which are on exchanging terms with this eminent institution. But as it may perhaps be desirable that the knowledge of the discovery of so remarkable an animal should not be withheld from the readers of this journal, I shall give some notes on it, referring for a more complete account to the excellent work of the learned author itself. This crinoid has principally been taken at depths of from one hundred to three hundred fathoms on the locality stated above, where it appears to live socially. A single dead specimen was found farther to the south, in the bay of Trondjem, at a depth of eighty fathoms. Carpenter and Wyville Thomson have also found it in other parts of the North Sea, and you know that it has been recently recognized that the "Bourgueticrinus Hotesieri," from the depths of the Gulf Stream between Florida and Cuba, is in fact a Rhizocrinus, and perhaps not specifically distinct from the Norwegian one. This will, however, if the identity should be farther proved, retain its name, as the West Indian Sea-lily was, without any sufficient reasons, referred to the quite indeterminable fossil fragments described by d'Orbigny. The greatest specimen has a length of eighty millimetres, the largest part of which belongs to the stalk, which attains a length of from twelve to seventy millimetres, and consists of from twenty-two to sixty-seven

joints. These joints are distinguished by two points of structure; first, that two articulated, branched "radicles," or "cirri," branch off from the distal extremity of the third to the thirty-second lower joints, and from the very end of the lowest, attaching the stem to various marine objects, fragments of shells, polyzoa, rhizopoda, etc.; secondly, that the joints are connected by true articulations in the manner of the fossil genus Bourgueticrinus from the chalk formation, a structure hitherto unknown in any recent Sea-lily, but also found, as shown by Prof. Sars in the stalked "pentacrinoid" stage of Antedon (Alecto, Comatula). There appears, however, to be no voluntary mobility in the stalk, and the purpose of this structure is, probably, only to give it a greater passive flexibility, the lines of articulations alternating regularly at angles approaching to the right angle. The upper joints are the youngest, shorter and thinner, with the exception of the very uppermost (to which the basals are, it appears, anchylosed, or by which they are at least entirely concealed); it is large, obconical, and serves, as in Bourgueticrinus, Apiocrinus, etc., as the base of the calyx, formed by the fourth, fifth, sixth or seventh series of "Radialia," three in each. Of seventy-five specimens, four radii were found in fifteen, five in forty-three, six in fifteen, and seven in two specimens; the radii are only connected together through the soft peristome. The first "radiale" is not visible from without. The third "radiale" wears but a single arm. These arms (whose number is of course from four to seven) are unbranched and built up of twenty-eight to thirty-six joints, connected, two and two, by a double joint (zygygium), and wearing on every second joint a "pinnula" (six to seven, rarely eight, on either side, consisting of eleven to twelve, rarely fifteen joints). The mouth is central, the anal opening short, eccentric, interradial; the peristome of the disc is soft, but strengthened by small, microscopical (from four to seven) perforated plates; five of these are greater than the others, and occupy the angles of the mouth; they are the "oral plates" of the pentacrinoid Antedon, disappearing at an early period in the adult. The mouth is provided with twenty (sixteen to twenty-eight) tentacles, longer and shorter, radial and interradial, pinnate, partly studded with spiculæ, etc., analogous in all respects to those of the arms and finlets, and of the ventral furrows from the mouth to the arms; the colored "vesicles," so characteristic of Antedon, are nowhere to be found. A double series of scale-like plates closes the furrows, when the tentacles are withdrawn. There are no "pinnules ovales." In a single specimen the three lowermost "pinnulæ" showed the incipient swelling of the continuation of the peristome, indicating the beginning and development of the genital organs, and intimating the important fact, that also in this stalked Sea-lily the sexual organs had their place in the pinnula of the arms, as in Antedon. (In Pentacrinus this fact has not yet been observed.) The single unbranched shape of the arms also confirms the hypothesis of d'Orbigny that the fossil genus Bourgueticrinus had simple, undivided arms, and Rhizocrinus is on the whole the nearest recent representative of the fossil genus. Also of its evolution something is known, intima-

ting its general accordance with that of Antedon. The second part of the memoir and its two last plates are devoted to the development of *Antedon Sarsii*, differing in several interesting particulars from that of *A. rosaceus*, as elucidated by Wyville Thomson and Carpenter. The reader who is acquainted with the extraordinary position of Prof. Sars at the University of Christiania, enabling him to devote himself almost exclusively to scientific pursuits, without being disturbed by the professional duties incumbent on most other scientific men, as curators of museums, lecturers, etc., will acknowledge the zeal and energy with which the author, though in a somewhat advanced age, continues his scientific work, as well as the enlightened liberality of the Representation, who did not hesitate to give an unusual position to a man capable of doing unusual work.

In the "Proceedings of the Academy of Christiania," for 1867, of which I was formerly only capable of giving an incomplete report, you will find some contributions to the geology of Norway (among which a paper by F. Dahl, announcing the discovery of gold and coal, probably Jurassic, in Finmarken, both however apparently not under such circumstances that the discovery can have any practical value), and a discussion about the theory proposed by Prof. Schybeler, that the short time in which the corn plants and other vegetables succeed in ripening their fruits in that northern country, is due partly to the clearness of the nights, the influence of light compensating to a certain degree for the want of heat; but a paper that has a more direct interest for North American readers, is Prof. Sars' "Determinations of a Series of Scottish and North American Glacial Shells and other remains." The Scottish collection embraced fifty species, principally from the Clyde district, of which thirty-three are also found in the glacial and fourteen in the post-glacial beds of Norway; the North American series collected by Dr. Packard, in Maine, Canada and Labrador, consisted of twenty-nine species, twenty-one of which are known from the Norwegian formations, while of the rest three or four are found in the British beds, the remaining four (*Cardita borealis*, *Pandora trilineata*,* *Thracia Conradi*, and *Aporrhais occidentalis*) are not known from this side of the Atlantic, neither in the fossil nor the recent state. — *Copenhagen.*

NATURAL HISTORY MISCELLANY.

ZOÖLOGY.

New Finner Whale. — The Academy of Natural Sciences has just obtained the perfect skeleton of a whale from the coast of Maryland. It is a finner, of the genus *Sibbaldius* Gray, and is half-grown and forty-

* This was wrongly determined; it is the *Pandora arctica*, a circumpolar species.—A. S. P.

seven feet in length. It is quite distinct from all known species, but is nearest *S. laticeps*. Its characters are found in the nasal and phenygoid bones, and in the cervical vertebræ, etc. I call it *S. tectirostris*. Two cervicals only have complete lateral canals; the nasals are short, wide, concave in front, except a prolonged keel in the middle line above, and in front.—EDWARD D. COPE, *Philadelphia*.

THE CORAL SNAKE.—In the March number of the NATURALIST, pages 86 and 89, Mr. Dall has given an amusing (?) account of his bravado in handling a snake, reputed to be very poisonous by the natives of Nicaragua, and called the "coral snake," which Mr. Dall calls "*Elaps? euryxanthus* Ken.," and says it is "perfectly harmless." It is well known that the genus *Elaps*, which includes a large number of species in tropical countries, all of them banded with bright colors, is closely allied to the notorious asp and viper of the old world, and that, like those deadly species, it is provided with grooved poison fangs, which are, however, quite small and inconspicuous in *Elaps*. We have received several species of *Elaps*, both from the East Indies and tropical America, under the name of "coral snake," and with memoranda stating the deadly character of its bite.

Now since Mr. Dall does not appear to know whether his "coral snake" is an *Elaps* or not, his foolhardiness in handling a snake having such a reputation becomes ridiculous. Of course his snake may have been harmless, and not an *Elaps*, since there are harmless genera so closely resembling *Elaps* as to be indistinguishable by external appearances, but Mr. Dall has not shown that his snake was of this sort, and by placing it in "*Elaps?*," would indicate the contrary.

It may, therefore, safely be said that the only sensible course for strangers to follow, be they naturalists or others, is to avoid unnecessarily exposing themselves to the bites of serpents reputed venomous by the natives of tropical countries.—A. E. VERRILL, *Yale College*.

NORTH ATLANTIC DREDGING EXPEDITION.—The Royal Society has applied to the Admiralty for the use of a steamer in order to continue the investigations so ably commenced by Dr. Carpenter and Prof. Wyville Thompson; and the "Porcupine" has been placed at their disposal. The expedition will take place about the middle of May, and the deep water, from 1100 to 1300 fathoms, near the Rockall Bank, will be the first explored, and afterwards the sea bottom lying off the outer Hebrides and the Shetland Isles.—*Annals of Natural History*.

HEARING OF CRABS.—We do not yet thoroughly understand how they [Crustacea] see, smell, or hear; nor are entomologists entirely agreed as to the function or the structure of the antennæ. This interesting subject offers a most promising field for study, and I would particularly call the attention of entomologists to a remarkable memoir, by Hensen, on the auditory organ in the decapod Crustacea. Hensen has shown that the [supposed] otolithes in the open auditory sacs of shrimps are foreign particles of sand, *introduced into the organ by the animal itself*. He proved

this very ingeniously by placing a shrimp in filtered water without any sand, but with crystals of uric acid. Three hours after the animal had moulted, he found that the sacs contained many of these crystals. M. Hensen has also shown that each hair in the auditory sac is susceptible of being thrown into vibration by a particular note, which is probably determined by the length and thickness of the hair. It may be experimentally shown that certain sounds throw particular hairs into rapid vibration, while those around them remain perfectly still. — *Sir John Lubbock in Scientific Opinion.*

A Box Turtle in Winter. — On February 4th, a large Box Turtle (*Cistudo Virginica*) was unearthed while digging in the barn-yard, and brought in, and is at present an inmate of the family, — on mild days travelling over the carpets at a pretty good rate of speed, and at other times taking refuge in dark corners and beneath furniture. Sometimes he is missing, and a grand turtle hunt ensues. We have consulted White's "Selborne," and have hopes of making an "old family tortoise" out of this one. He is a convenient pet now, not requiring to be fed, and is protected from an inadvertent footstep by his armor. — Mrs. V. W., *Rye, N. Y.*

A Doe with Horns. — A young man recently shot a deer of splendid proportions, and carrying a beautiful pair of antlers, each with four branches. It proved to be a doe, and hundreds have since seen it who will attest its sex, none of whom ever before saw a doe with such a *neck* and *horns*. It lies daily in front of the door next to my office, waiting for a bid from Barnum. Can you inform me whether this is a new fact in natural history or not? — L. P. Hatch, *Minneapolis, Minn.*

[We have never heard of a female deer assuming the characters of a male before, but it is well established that female birds, living to old age, often assume the plumage, and to a certain extent the habits of the male. In the Museum of the Academy there is a Pea-hen, that in the spring before her death, at the age of nineteen years, changed her dull female plumage for the bright plumage and full trail of the male bird. N. Vickery, Taxidermist, of Lynn, has the specimen mounted. — Eds.]

Familiarity of a Weasel. — Three times during the month of January last, a weasel came from a pile of logs, and advanced towards a man who was cutting wood in the vicinity, and played about him, quite regardless of the presence of spectators and not disturbed by their conversation. The animal was of a reddish brown color, with a pure white breast. — Mrs. V. W., *Rye, N. Y.*

Fossil Jelly-fishes. — M. Hæckel has described some fossil jelly-fishes belonging to the groups Discophora and Rhizostomida, from the Jurassic, etc., lithographic slates at Eichstadt. — *Cosmos.*

Albino Robins. — Two albinos of the robin were presented to the Buffalo Society of Natural History last autumn. Both were shot near that city. — Charles Linden.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

THE WORCESTER LYCEUM AND NATURAL HISTORY ASSOCIATION.—The annual meeting of this association was held on Wednesday, May 5, 1869. The different reports read indicated that the society was in a very flourishing condition, and that its efforts to make a good cabinet of specimens had been quite successful.

A committee on Field Meetings was chosen, with the President as chairman, and a determination was manifest on the part of all present to make the meetings interesting and profitable to members and the public. Nathaniel Paine was elected President, with an able corps of officers.

ANSWERS TO CORRESPONDENTS.

E. A. S., Grand Rapids, Mich.—Your drawing appears to be that of *Papilio Marcellus*.

W. G. B., Salem.—*Cynthia Lavinia* Harr. is a very rare butterfly throughout New England. Dr. Harris' specimen was taken in Milton. Mr. Scudder reports a specimen from Cape Cod. You say you have captured one in Hamilton, and we are informed that Mr. Bennett, of Holyoke, has found one in his neighborhood. Out of Massachusetts it has been taken at Hampton, N. H., and is occasionally seen in Connecticut. Its proper home is farther south.—S. H. S.

W. W. B., Providence, R. I.—The Index to Vol. I. has not yet been printed.

B. S. M., Olney, Pa.—The Saw-flies are probably *Selandria rosæ*. An account of it is given in Packard's "Guide to the Study of Insects," p. 223, and in Harris's "Treatise on Injurious Insects."

S. M. M., Mauch Chunk, Pa.—It would be impossible to give the names of the birds from your descriptions. Send us skins by mail, and we will identify them for you.

BOOKS RECEIVED.

Journal for the Diffusion of Natural Science. Third Series. Vol. i, No. 2. Copenhagen, 1869.

Farm Implements and Farm Machinery, and the Principles of their construction and use. With 287 illustrations. By John J. Thomas. New York: Orange Judd & Co. 12mo. pp. 302. Price $1.50.

A Synopsis of the Birds of the Hawaiian Islands. By S. B. Dole. 8vo. pp. 16. Boston, 1869.

Notes on the Eruption of the Hawaiian Volcanoes, 1868. By W. T. Brigham. 4to. pp. 23. Boston, 1869.

Four New Genera of Hawaiian Plants. Notes on *Hesperomannia* by W. T. Brigham, and on *Isodendron, Platydesma*, and *Brighamia, with an Analysis of the Hawaiian Flora* by Horace Mann. Boston, 1869. 4to, pp. 14, four plates.

Parsons on the Rose: A Treatise on the Propagation, Culture, and History of the Rose. By Samuel B. Parsons. New and revised edition. Illustrated. New York: Orange Judd & Co. $1.50.

The Mississippi Valley: Its Physical Geography, including sketches of the Topography, Botany, etc. By J. W. Foster, LL. D. Illustrated by maps and sections. Chicago: S. C. Griggs & Co. 1869. 8vo, pp. 443. $3.50.

The Practical Poultry Keeper: A complete and standard Guide to the Management of Poultry. By L. Wright. Third edition, Illustrated. New York: Orange Judd & Co. 12mo, pp. 243. $2.00.

Fishing in American Waters. By G. C. Scott. Illustrated. Harper Brothers, New York, 1869. 12mo, pp. 485.

Le Naturaliste Canadien. May.

Popular Science Review. April. London.

Occasional Papers of the Boston Society of Natural History. I. Entomological Correspondence of T. W. Harris, M. D. Edited by S. H. Scudder. 8vo, pp. 375. Portrait, four plates, forty-six cuts, $5. Published by the Society, and for sale by the Naturalists' Book Agency.

Bulletin of the National Association of Wool Manufacturers. April, 1869. Boston. 8vo.

THE

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RAMBLES IN FLORIDA.

BY R. E. C. STEARNS.

FLORIDA, the "Land of Flowers," the enchanted ground wherein it has been said Ponce de Leon sought for the "fountain of perpetual youth," is not far away; the fountain, quite likely, is as remote as ever, but the land which it was said to bless with its everflowing and rejuvenating waters, can be reached after a journey of a few days from New York, by steamship if the traveller is not unpleasantly affected by a sea-voyage, or, if the apprehension of "rough weather off Hatteras" should make a different route preferable, then by rail to Charleston, thence by steamer over waters generally smooth to Fernandina, stopping on the way at Savannah just long enough to look about and obtain a general idea of the place.

Fernandina, situated on Amelia Island, is the principal town upon the east coast of Florida, and of importance, being the eastern terminus of a line of railway which connects the Atlantic Ocean with the Gulf of Mexico. Its population is not far from fifteen hundred. At first sight it is not prepossessing, but a walk about the place reveals many buildings of pleasing architecture hidden among the trees.

Within a small enclosure not far from the landing, "the . . . forefather of the hamlet sleeps." Upon a marble stone may be seen the name of

DOMINGO FERNANDEZ,
NATIVE OF VIGO IN GALLICIA, SPAIN.
BORN THE FOURTH DAY OF AUGUST, 1766.
AND DIED THE THIRD DAY OF SEPTEMBER, 1833.
IN THE SIXTY-SEVENTH YEAR OF HIS AGE.

Señor Fernandez, it is presumed, never found the fabled fountain, or, drinking of its waters they were powerless to avert the inevitable doom of man. The morning was pleasant; the sun shone brightly; it lighted up the cross and gave roundness to the skull and bones that are carved above his name. From an oak near by the Spanish moss hung drooping midway to the ground, casting a filmy shadow, and hiding a choir of mocking-birds,* who filled the air with music.

Leaving the grave of Fernandez and following the streets, a careful search in the loose sand of which they are composed will disclose fragments of pottery of the size of a penny, perhaps a part of the debris of some aboriginal tribe once camped hereabout, the souvenirs of a race, of whose history how little is known!† Farther on is an ancient mound of large size, nearly three hundred yards in circumference. Undisturbed ten years ago its surface was as the builders left it, but its slopes and summit were so changed, through the military purposes for which it was used during the recent civil war, that its original proportions are destroyed, and its former outline obliterated.

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* *Mimus polyglottus* is quite common here; many persons are not aware that this bird has a song of its own, which is very musical and sweet; the popular idea seems to be that its notes are exclusively imitative. In and around Fernandina may frequently be seen, at this season at least (January), the beautiful Ground Dove (*Chamæpelia passerina* Swainson), of which some specimens were obtained.

† "At the landing of Fernandina, on Amelia Island, the summit of the bluff is covered with a layer of artificially deposited shells, extending about two hundred yards upon the bay, and one-fourth of a mile inland, varying in depth from one to four feet. The shells are in many places so rotten as to fall to pieces at the touch, some showing fractures made at the edges as if in opening, while others have obviously been subjected to the action of fire." [D. G. Brinton, M. D., in Smithsonian Report, 1866.

About a mile from the town towards the ocean is the lighthouse, built upon somewhat elevated ground, forming with the adjacent buildings and moss-festooned oaks, a bit of highly picturesque and pleasing scenery.

Between the lighthouse and the road to the beach, not far distant, is another mound in the centre of an ancient camping ground, the latter covered with bleaching shells, the remnants of unrecorded clam-bakes and oyster-feasts. This mound is much smaller than the first, only about one hundred yards in circumference and about fifteen feet in height; it was covered with trees and shrubs,* the largest of the former being perhaps nine inches in diameter; their roots penetrating the loose material of which the mound is composed, and in their ramifications wound and twisted among the skeletons of unknown men whose decayed bones crumbled at a touch. Stone implements were found, and in the surrounding field fragments of earthen-ware less perishable than the hands that made them.

From here to the ocean the path lies through a low and, in some places, dense growth of Saw-palmetto,† interspersed with one or more species of Cactus. The leaf-stalks of the former have sharp points along the edges, hence the name; and the prickly *Cactaceæ* may be considered the porcupines and hedgehogs of the vegetable kingdom. Though painful to the touch and dangerous to the apparel they should not be denounced; many of the *Cacti*, as well as of the *Palmaceæ*, to which family the Saw-palmetto belongs, bear delicious fruit, and some species of Cacti are the feeding parks of the insect,‡ from which the celebrated scarlet dyestuff, known as cochineal, is derived.

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* *Xanthoxylum Carolinianum* Lam., or Prickly Ash, also called "toothache tree," is common here. It is said to possess valuable medicinal qualities; a piece of the bark put in the mouth and chewed produces a stinging sensation, causing the tongue to feel as the hand feels after grasping a nettle.

† *Chamærops serrulata.*

‡ *Coccus cacti.* The cochineal of commerce resembles dried berries more than bugs, the *C. cacti* of which it is made are gathered alive, scalded, and then dried. It is estimated that every pound of cochineal contains 70000 of these insects, and from half to three-quarters of a million of pounds are annually sent to Europe.

Without enlarging upon the merits of the Palms and Cacti, which would require a volume, we will consider the species we have encountered as unworthy representatives of noble families, and proceed upon our way.

It is hard work for either man or beast toiling through shifting sands, but pressing on we soon achieve the summit of the mimic mountain range, which the wind and sea always pile up on the landward side of the shore. Descending the slope we are face to face with old ocean, whose majesty, whether in storm or calm, is ever impressive; the sea is smooth, the surf beats gently on the beach. We pause a while to admire the glories of sky and water; to ponder upon the mysteries of life and form that dwell within the broad blue bosom of the deep; to peer into the hazy beauty of the atmosphere which hangs like a curtain at the remote horizon, implying hidden and greater beauty beyond; to note the distant sails of coming or departing ships; or watch the gulls riding upon the ripples like tiny shallops at anchor; to recall how in the north the wintry winds nipped us on New Year's day, only a week or two ago, and how bland and genial are the breezes here; to behold at our feet as we follow the more recent drift-rows, the rejected treasures which the sea has cast aside, forms different from any that we have elsewhere found, and each curious in its way.

There are but few sea-weeds (*algæ*) on the beach, and not many species of shells; of some of the species, however, many individuals can be obtained. Here are numerous specimens of the Fan Mussels (*Pinna*). What is written of the lilies of the field, "they toil not, neither do they spin," does not apply to them; for these submarine weavers spin a byssus, or beard, by which they attach themselves to the bottom of the sea: the byssus serves as a mooring cable, and its fibres are tubular, like human hair. When fresh and flexible, gloves and stockings can be woven from it, and at Tarento it is manufactured into articles of wear "According to Vérany the byssus is a successful remedy

for the earache, but he does not say in what manner it is applied."* *Pinna rudis*, an English species, is sometimes eaten, and Henry and Arthur Adams also mention that some species are used for food.†

A dead fish, half eaten by the birds, is not an attractive object; it is in an unsavory state, but doubtless its scales would, under a microscope, astonish us with many lines of beauty. The butterflies, so unlike the fishes in form and habits, also have minute scales, hence the metallic lustre and brilliancy of their coloring; impalpable to the naked eye, their tiny scales resemble the pollen of flowers. Columbus "gave a new world to Castile and Leon;" but think of the world of enchantment, of the precious treasures that the microscope has opened to all.

A thin slice cut from a spine of the Sea-urchin (*Echinus*) that we have just picked up, if magnified, would furnish a partial insight to the wonders of its plan of structure.

We find the oblong pouch-like egg-cases of a species of Skate (*Raia*) quite common. The texture and color of these pouches are such, that a person not knowing would sooner suppose that in some way they rather belonged to the sea-weeds, perhaps the pod of a species of Alga, than pertaining to the fishes. If we were strolling along the shores of California or Europe we should meet with the same queer forms. In England the people call them "pixy-purses," "fairy-purses," etc. A species of Dog-fish (*Scyllium*) makes a similar purse-like egg-case, with long strings at the corners. The Skate-fishes are eaten in England, and appear in the stalls of the Italian fish-market in San Francisco, the Californian species may generally be found, but they are eaten only by the foreign population. The common English Skate sometimes attains the weight of two hundred pounds; it is used by the fishermen for bait.

*Jeffreys.

†Two species of *Pinna* may be found on the beach of Amelia Island: *P. Carolinensis* Hanley, and *P. squamosissima* Phil.; they are quite common, particularly the former. I do not think they were eaten by the aborigines, as none of the shells, or even fragments, were found in any of the heaps or mounds.

The skates and dog-fishes are not the only marine animals that make curious egg-cases. We have here three species of univalve shells, called by the Floridians, Conchs* (*Busycon*†), which also make egg-cases. Each case is round and flat, about one-half to three-fourths of an inch in diameter, and one-sixth of an inch in thickness; the edge of each flat case is coarsely ribbed or milled, and numbers of them are strung together, only they are immovable upon the string, which is situated upon one side or edge, instead of being central as in a bead necklace. These egg-chains are sometimes two feet in length, and the cases are frequently bored into by different species of carnivorous mollusks to obtain the contents for food. These Conch animals were probably eaten by the aborigines, as we find the shells quite numerous in their Kjœkkenmœddings; they are now sometimes eaten by both the whites and negroes of Florida, but from appearances they must be tough chewing, and as indigestible as a rubber boot.

At the edge of the beach, rolling in the surf-ripples, a large fleet of Ark shells is coming ashore; these prettily ribbed bivalves look like the Cockles (*Cardium*), but the animal and the hinge are quite different. The velvety epidermis which generally covers the surface has been worn off by the friction of sand and water in the surf, exposing the clean white fabric of the shells; lighted by the sun they look like a squadron of little dismasted hulls. Two of the three species that we have here obtained are widely distributed, and may be picked up near Galveston, on the Gulf of Mexico. Some of the family may be found in every sea, and many species are used for food. The animal of *Arca grandis*, which is found in the Bay of Panama, is eaten by the natives; a single valve of this giant Ark

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* Indiscriminately used when reference is made to any species of the Pyrulidæ, Strombidæ, Fasciolaridæ, etc., found here.

† *B. canaliculatum* and *B. carica* of Linnæus, also collected by me as far north as New Bedford, and *B. gibbosum* of Conrad, the latter considered by many as only a variety of *carica*, but showing well marked peculiarities.

sometimes weighs two and a quarter pounds. Odd valves of the Ark shells are found in the shellheaps, but are not common.

A mile and a half from where the road enters the beach are the remains of two wrecks; the planking of the decks and sides has long ago been broken up and swept away by the sea, and the timbers projecting from the sands resemble the ribs of some gigantic mammal. No vestige of name is left; their wooden skeletons tell of fierce storms, when wind and waves, acting in unison, hurled ships and shells, and sea-weeds, like weightless bubbles, upon the beach. A wreck is a sad sight, but the crevices of an old hulk are a fine field for the naturalist, for many forms of marine life have a home therein. Here we found a tiny species of Mussel (*Mytilus cubitus*), and a new species of *Siphonaria*, a univalve shell shaped like a small shield, with elevated lines or ribs radiating from centre to circumference.

Without farther enumerating or explaining the prizes that are ours through the bounty of old ocean, we must retrace our steps towards the road, for the sun has so nearly set that its level rays are shining in our eyes. With baskets and pockets packed and full we jog along, stopping occasionally to pick up a fine specimen of a white bivalve shell, *Dosinia discus*, which is very abundant, thanks to a storm which threw them high and dry above the reach of ordinary tides. The Fish-crows (*Corvus ossifragus*) and a large species of Blackbird (*Quiscalus baritus*) are running over the wet sands, stooping sometimes to pick up some tit-bit for their suppers. Bidding them good-bye, we hurry on, and after a weary walk of what seemed many miles, made longer by the toilsome tug through sand and chapparal, we reach our haven; tired as dogs (at times are said to be) we gladly cast aside our packs, and after a refreshing wash, rush to supper with appetites as keen as hungry wolves!

The evenings here are chilly, and a fire of the Pitch-pine wood (*Pinus palustris* Linn.) is pleasant, aside from the

warmth, for its bright flames fill the room with a cheerful light. . . . . . . How glorious is sleep after a day of toil; of toil, yet still of pleasure. How gently it descends upon us, how quietly we yield to its embrace; it touches the drowsy eye, and we feel that

"The day is done, and the darkness
Falls from the wing of night."

MONSTROSITIES AMONG TROUT.

BY A. COOLIDGE, M. D.

THE egg of a fish consists of an enveloping membrane containing the yolk or vitellus. The first step in the development of the egg is the formation of innumerable cells on the surface of the vitellus, which are closely packed together, and form a new membrane or layer surrounding the vitellus. The next sign of organization is the thickening and condensation of one spot of this new layer. The thickened part has an elongated oval shape, and in its centre, running longitudinally, is a delicate line or furrow.

This is the first beginning of the fish. The backbone of the fish is formed around this furrow. The anterior extremity spreads to become the cavity of the brain, and the tail grows from the posterior end. The yolk remains enclosed in the new layer as in a sac; as the fish grows this sac becomes constricted, so that the upper part of it is taken up into the body of the fish, while the lower part remains hanging out, and is called the umbilical vesicle, and it is in this condition that the fish is hatched. He is attached to the upper part of the umbilical vesicle, which being too heavy for him to move, he remains anchored by it, as it were, at the bottom of the stream, wriggling only his head and tail. The fish is fed by the absorption of the contents of the vesi-

cle which decreases every day as he grows larger. After some days he is large enough to swim about with the vesicle under him, and at the end of forty to fifty days the sac is no longer to be seen, and the fish swims freely about.

All fish, however, are not perfect and oftentimes deformed ones are met with. Sometimes, instead of there being one fish only attached to an umbilical vesicle, there are two; not two separate ones, but two heads attached to one body, or two bodies attached to one tail, as shown in Figs. 47 and 48. This curious partial duplication of the fish takes place in the egg long before it is hatched, and is due, probably, to a bifurcation of the furrow around which the backbone of the fish is formed. The cells of the thickened oval spot, instead of forming one straight furrow, for some reason or other form one in the shape of a Y. Two backbones form around the two branches, with two heads, while one tail has to do for both.

Fig. 47.

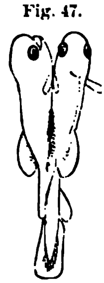


Fig. 48.

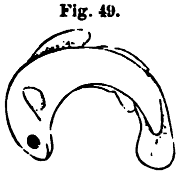
As far as has been observed it is always the anterior part which is duplicated. No one body with two tails has been found. The tail remains single while the head and body are doubled; and this duplication varies from a partial division of the head only to two nearly complete fish, with different brains, and hearts, and stomachs, and whose hearts do not even beat together, though the circulation in the tail must be common to both. On the other hand the head alone may show signs of duplication. One young fish was found in whom this had extended only to the partial division of the head. Of the four eyes the two middle ones were not completely separated; they looked something like a figure of 8 on its side. Generally one of the half fish is larger and stronger than the other, as seen in Fig. 48, and carries the smaller one off wherever it will, notwithstanding the apparent effort of the smaller one to go somewhere else.

These double fish are not very common, and as they die after the vitelline sac has been absorbed they are not seen by fishermen. The ratio of these deformed fish to the number of eggs in the hatching troughs was roughly estimated at twenty to twenty thousand, or one in a thousand eggs.

But a curious fact proved that the eggs of some fish contained a larger proportion. One large blind trout had a small pond to herself, and was fed daily by food presented to her on the end of a stick. Her eggs were kept apart, and out of about two thousand there were sixteen deformed fish, or one to one hundred and twenty-five eggs. Certain fish would seem to be more predisposed to produce eggs creating these monstrosities, and were we to ask for the cause of this, we should probably have to look for it in some anomaly of the ovary of the fish which produces the eggs.

A deformity more common than the double fish is an apparent curvature of the spine. The fish instead of being straight, with the umbilical vesicle under him, is curved round so that its tail turns under, and sometimes touches the under surface of the sac he is attached to. Fig. 49 represents one of these semicircular fish. They are obliged to swim on their side, and move round and round in a circle, or in a spiral, without being able to go straight.

Fig. 49.



These deformities are mentioned and treated by Buckland in his "Fish Hatching." He there suggests that humpbacked deformity may have been caused by pressure during their "transport in the egg state." In the instances mentioned above, however, there was no transport, the ova being taken from the fish on the spot.

Out of two thousand salmon ova hatched at Messrs. Dexter & Co's fish-farm, there were no deformities, but in another lot of about the same number there were two double-headed specimens just hatched out.

THE COW BLACKBIRD.

BY T. MARTIN TRIPPE.

PARASITIC animals are, for the most part, confined to the lower grades of life. Among the Articulates they constitute whole groups; they are less numerous in the Radiates and Mollusca, and when we arrive at the Vertebrata we find very few animals of this nature. As a general rule, the parasitism in these higher types is less complete than in the lower species. Of parasitic birds there are very few examples, North America possessing but a single species, the well-known *Molothrus pecoris*, whose history we shall briefly sketch.

The Cow-bird, as it is generally called, is spread over the whole continent, from the Atlantic to the Pacific, and from Mexico to Hudson's Bay. It winters in the Southern States, from Virginia southward into Mexico, frequenting the old corn and rice fields, or gathering in small flocks around the cattle in pastures. About the middle of March it begins to appear in the neighborhood of New York, at first only a few appearing in company with the Red-winged and Crow Blackbirds, but by the end of March or beginning of April, as soon as the spring becomes somewhat settled, they become abundant. They are now seen in numerous small flocks of from five to twenty, of which the females comprise at least two-thirds. These small flocks, or parties, continue in the neighborhood of New York until about the middle or end of June, according to the season, after which time none are seen except, perhaps, a female or two. Towards the early part of September they reappear in numerous flocks of from fifty to five hundred individuals, or even more. They now scatter themselves over the fields, frequenting for the greater part of the time the pastures, where they feed upon the swarms of insects that are constantly to be found in the

vicinity of herds of cattle. Later in the fall they sometimes associate with the Red-wings, which have now also gathered into flocks. About the middle of October they leave us for the South.

Like the European Cuckoo, the Cow Blackbird lays its eggs in the nests of other birds, never building one for itself. It usually selects the nest of a bird smaller than itself, and never forcibly drives away the rightful owners in order to take possession itself, but waits until they are absent, and then secretly and quickly deposits the egg. Among the birds who are thus victimized are the Red-eyed and White-eyed Vireos, the Maryland Yellow-throat, the Bluebird, Indigo-bird, Chipping and Song Sparrows, Yellow Warbler, Golden-crowned, Wilson's, and Wood Thrushes, Blue-gray Flycatcher, Yellowbird, Towhee Bunting, Black and White Creeper, Purple Finch and Bay-winged Bunting. The favorites are the Maryland Yellow-throat, the summer Yellowbird, and the Vireos.

The egg of the Cow Blackbird is of a dirty white, thickly sprinkled with spots and dashes of reddish brown. Some of these spots are darker than others, and different eggs often show some slight variations in color, as is generally the case, indeed, with all streaked and spotted eggs.

One egg is the most ordinary number in the same nest, but occasionally there are two, one of which, Audubon observes, usually proves addled. I never heard of more than two instances where there were more than two eggs of the Cow-bird in a single nest. Prof. Baird and Dr. Brewer once found three eggs in a nest of the Black and White Creeper, and I once had the good fortune to discover a nest of the same bird containing five eggs of the parasite, together with three of her own. In the latter case, incubation had begun, and all of the eggs contained embryos.

The young Cow Bunting usually breaks the shell a short time before the other occupants of the nest, who, from this circumstance, and the fact that they are smaller and weaker

than their intruding nest-mate, almost always perish. In the latter part of May, and during June, the young Cow-birds may be seen flitting through the woods and orchards; but at this time of the year they do not frequent the open fields as the adult birds do. They do not entirely disappear until July, when most of the small birds have raised their first broods. In September they return in flocks along with the old birds. They do not attain their full plumage until the following spring.

It is not often that the Cow-bird lays her egg in an empty nest, but I have known of one or two instances of the kind. In such cases the owner always, as far as I can learn, deserts her nest. But if, as is almost always the case, she has laid one or two eggs before the parasite has deposited her's, she will generally remain, though often with apparent reluctance. Some birds, however, will often desert their nests even if they have laid in them first, as the Song Sparrow and Wood Thrush. At times some birds show great ingenuity in getting rid of the intruding egg, by building a second floor to the nest, above the egg, thus completely covering it up. The Yellow Warbler, a frequent victim of the Bunting, often adopts this method of freeing herself from the annoying parasite; and I have known the Song Sparrow to adopt the same plan. An instance is on record in which a Yellow Warbler, having built a second floor to her nest over an egg of the Cow-bird, found another egg of the same bird laid upon her second story, whereupon she went to work again and built a third floor over the second egg. I have known the Cow Bunting to lay her egg on the second story of a nest, but the bird, in this instance, deserted her nest.

The notes of the Cow Blackbird are not many in number, nor musical in tone. When flying, the male utters a whistling sort of note, composed of two syllables. At other times, when perched upon a tree, he utters his love-song, which is composed of two loud preliminary notes, which

Nuttall compares to the syllables "gluck tsee," followed by a medley of low gurgling notes. On a warm morning in April the males will sit upon the tops of the maple and apple trees in the pastures and orchards for an hour at a time, repeating at short intervals their jingling notes, to the intense satisfaction, apparently, of themselves and their numerous mates who sit around them in admiring circles. While uttering these notes the bird struts and swells like a turkey-cock, and with the same intention—the desire of pleasing his mates.

The food of the Cow Blackbird consists principally of insects, especially flies, grubs, beetles, etc. They eat also the seeds of various plants, and at times join the Red-winged and Crow Blackbirds in plundering the cornfields; but the injury that they thus inflict is very slight, and is far more than overbalanced by the good they do in devouring vast numbers of noxious insects. Hence they deserve the protection of the farmer; but as they are often found in suspicious company, viz., with Crows and Red-winged Blackbirds, they frequently suffer the penalty of associating with proscribed thieves and rogues, by being shot down with them.

NOTES ON THE FAUNA OF THE UPPER MISSOURI.

BY J. G. COOPER, M. D.

IN May, eight years since, I was attached to a military expedition on its way to the Pacific Coast, via the Missouri and Columbia Rivers, which had just been connected by a military road constructed by Capt. John Mullan, U. S. A. It was chiefly for the purpose of trying its practicability that the party of about two hundred and fifty men and several officers, under the command of Major G. M. Blake, was sent by this new route instead of by the Isthmus of Panama.

Of the two months spent in ascending the Missouri to Fort Benton by steamboat, I will not write very fully, although the tediousness of the trip was enlivened by many interesting scenes, and by observations and collections of numerous specimens of small mammals, birds and eggs. These I packed and directed to the Smithsonian Institution, but they were never received there; the eggs were all collected west of Fort Union. I will briefly enumerate the species for the benefit of future collectors and students of the summer range of our birds. The valley of the Missouri, along that portion, is usually bordered by low trees and shrubbery in the bottom land, while the uplands are quite bare, or only a few stunted trees occur where springs issue from the bluffs.

June 17th, I found the nest and eggs of *Empidonax pusillus* (probably), on a low tree in a dense dark thicket, built in a sharp crotch; 18th, the nest of the Western Red-tailed Hawk (*Buteo montanus*), with two eggs partly hatched, on a small oak at a distance from the river; also, two eggs of the Dove (*Zenaidura Carolinensis*), and one, said to be that of an eagle (?), were brought in by the men. The Wild Pigeon (*Ectopistes migratoria*) also breeds here. I found the nest and four eggs of the Lark Finch (*Chondestes grammaca*), situated as usual on the ground, and one of some uncertain sparrow. The next day I obtained that of the Shrike (*Collyrio excubitoroides*), with six eggs; and one of the Shore Lark (*Eremophila cornuta*).

A leak having opened in the boiler we were delayed near this place the third day also, and I found it a perfect nursery of birds, the shrubbery on the north bank being full of them and their nests. I obtained there also eight nests of the Redstart (*Setophaga ruticilla*), with eggs; that of the Chat (*Icteria viridis*), with four eggs; of the Black-headed Grosbeak (*Guiraca melanocephala*); of some small Thrush (*Turdus Swainsonii?*); of the Cat Bird (*Mimus Carolinensis*), and two of the Chippy (*Spizella socialis*). I

saw also species of Vireo, (*Pipilo arcticus?*), *Dendroica æstiva*, *Colaptes* (*auratus?*), *Geothypis trichas*, and *Certhia Americana*, which, probably, had nests near there. The locality is about fifty miles by the river west of Fort Union.

The absence of shrubbery, except close to the river, confines most of the small birds to a narrow range, and makes it easy to find their nests, none of the trees being large. It will be noticed that at least two species peculiar to the western half of the continent breed so far east, and it is possible that the Empidonax, Pipilo and Colaptes, were also of the western types. The rocky bluffs which border the river above the Great Bend, and are often high enough to appear like mountains, although only the escarpment of the Great Plains, apparently favor an extension eastward of the Mountain fauna to this point; the Mountain Sheep (*Ovis montana*), Woodrat (*Neotoma cinerea*), and perhaps other mammals coming down in company with the birds, etc. At the same time it is remarkable that all the eastern birds mentioned *extend in this latitude* entirely across the Rocky Mountains, though most of them do not even reach the mountains northward, and seem, therefore, to follow the Missouri River westward, in their spring migrations.

On June 22nd I obtained eggs of the Brown Thrush (*Harporhynchus rufus*) which is common to the Rocky Mountains. I noticed some species of Swift (Chætura?) with a white throat, but too high to shoot. We reached the north of Milk River, where large herds of buffalo were passing towards the South, very few having been seen below that point. That pretty and musical bird of the high plains, the Lark Bunting (*Calamospiza bicolor*), also occurred near there, and extends east to Fort Union.

The bluffs from Milk River to Fort Benton are higher and more rugged, with groves of coniferous and other trees at intervals, being spurs of the Black Hills, which form the first range of the Rocky Mountains. I had little opportunity for collecting along this interesting portion of the

route, and obtained only the eggs of some unknown warbler; of a Pipilo; of the Robin (*Turdus migratorius*), which had its nest built in a split trunk of a fallen tree; eight eggs of the Rock Wren (*Salpinctes obsoletus*), found in a log-house which was torn down for fuel; two nests and nine eggs of the Shore Lark (*Eremophila cornuta*); and one of a Night-hawk, probably *Chordeiles Henryi*, which I found on the bare gravelly bluff. I noticed here the first Magpies (*Pica Hudsonica*) and a strange Woodpecker.

Arriving at Fort Benton July 2nd, we remained in camp there until August 7th, and this being the worst season for collecting specimens I obtained but few. The country near the fort is also too flat and bare to be productive of a great variety of animals, being exactly in the middle of the wide valley lying between the Black Hills and Rocky Mountains, while there are few trees or bushes along the river. The river, however, furnishes quite a variety of fish, including Pike (Esox sp.), Catfish (*Pimelodus olivaceus* and *Noturus flavus*), Pike Perch (*Stizostedion boreus*), Grunter (*Amblodon grunniens*), Carp (*Carpiodes damalis*), and several other Cyprinoids which furnish much sport, and some of them good eating. Dr. Hayden's "Report of Explorations in Nebraska," for 1859, gives full lists of these and other animals found by him during several years collecting in this region.

At and above the Great Falls, thirty miles higher up the river, we also found trout abundant (*Salmo Lewisii*), and also a *Coregonus*, and other species of fishes apparently new. It is somewhat singular that the fresh-water Mollusca which I found here were all different species from any obtained by Dr. Hayden in the lower parts of the Missouri and its branches, except *Unio luteolus* and *Physa heterostropha*, the rest being *Limnæa palustris*, *bulimoides* and *desidiosa*, *Sphærium striatinum*, *Margaritana* (*margaritifera var?*) *falcata*, while Dr. Hayden obtained thirty other species in Nebraska. The above, also, are nearly all found west of the Rocky Mountains, or represented there by closely allied

species, and one or two are circumboreal. (See Annals of the New York Lyceum, Vol. vii.)

I do not undertake here to enumerate nearly all the species of animals seen or collected, as Dr. Hayden has made a much fuller collection of them than I could do in so hasty a journey.

Rattlesnakes (*Crotalus confluentus?*), some small Lizards (*Sceloporus* and *Plestiodon*), and the curious Horned Toad (*Phrynosoma Douglassii*) were all the reptiles observed in this dry season, though several others doubtless occur in spring.

Young Curlews (*Numenius longirostris*) and Field Plovers (*Actiturus Bartramius*) were common on the plains. The Mountain Plover (*Ægialitus montanus*) appears on the driest plains among the villages of the Prairie-dog (*Cynomys Ludovicianus*). I also shot some immature Buntings (Plectrophanes), of which three species are found in Nebraska, and confined to the Great Plains east of the Rocky Mountains.

Near Sun River, which is a clear swift mountain stream, I observed some middle-sized Squirrels (*Spermophilus Franklinii?*), but they were so exceedingly shy that I did not succeed in getting any. Here the Rocky Mountains became fully visible, and mountain trees line the banks of the river. I noticed here the first of Lewis' Woodpecker (*Melanerpes torquatus*), which never leaves the neighborhood of the mountains. On the east side of the Missouri high ranges are also visible, and the road now commences to ascend over rolling and often rocky hills, with pine woods on the higher parts. August 13th two eggs of the Night-hawk were found nearly hatched, laid as usual on the bare ground. At the mouth of Prickly-pear Creek the Dusky Grouse (*Tetrao obscurus*) was first found, in company with the prairie-loving Sharp-tail (*Pediœcetes phasianellus*), which we had found all along the Missouri River.

Going up the valley of this creek we passed over high and thickly wooded ridges, where I saw Clarke's Crow

(*Picicorvus Columbianus*), the Clay-colored Sparrow (*Spizella pallida*), and obtained a specimen of the long-tailed Chickadee (*Parus septentrionalis* var? *albescens* Baird). The Red Crossbill (*Curvirostra Americana*) and Pigmy Nuthatch (*Sitta pygmæa*) were also common, with other species which scarcely ever leave the mountain forests. August 17th we encamped only three miles from the summit of Mullan's Pass, and nearly six thousand feet above the sea, where I observed a large Marmot (*Arctomys flaviventer*) and a Weasel (*Putorius longicauda?*). I also shot the first Oregon Grouse (*Bonasa Sabinii*), and saw MacGillivray's Warbler (*Geothlypis MacGillivrayi*).

THE LILIES OF THE FIELDS, OF THE ROCKS, AND OF THE CLOUDS.

BY PROF. G. HINRICHS.

"Consider the lilies of the field,—even Solomon in all his glory was not arrayed like one of these!"

THESE beautiful words and their promise are familiar to all of us; but we are perhaps less conversant with the beauty of form here referred to. The season of flowers is now with us; we have, therefor, each and all, abundant opportunity to consider or behold the plants in their own glory. A few words of explanation, and a few examples from the world of flowers may, perhaps, be an additional incentive to look upon the flowers themselves; and it may also prove interesting to show that there are objects deeply buried in the rocks, and also high up in the sky, which contain the same essential elements of beauty so much admired in the lilies of the field.

To the botanist the lilies comprehend a very large group of plants. A great number are distinguished for the brilliancy of their colors; as the numerous tulip-varieties and

the lilies proper. The lily of the valley (Fig. 50) is of a pure white; hence its beauty cannot be sought in its color,

Fig. 50.

but must principally be due to its peculiar form. In the lily family the form of the flower is perfectly regular; the three leaves of the calyx are succeeded by three leaves of the corolla; then follow the six stamens, and in the centre of the flower we find the three pistils. These parts may be very easily recognized in the figure of the open flower and the bud of *Scilla* here added (Fig. 51).

Fig. 51.

In the Iris family—of which a section of the flower, bud and pod is illustrative—we notice also that the parts are all threefold; here, even the stamens are three in number, and not six as in the lilies. A like symmetry and regularity of flower is exhibited by many large trees, as the Date-palm (Fig. 52), the leaves

Fig. 52.

of which are the *Palms* of Scripture; and even microscopic parts of the flower, like the pollen grains, often show a similar regularity. (Fig. 53.)

Fig. 53.

That color cannot be the most important element of the beauty of these flowers, we may conclude from the fact that even the imperfect uncolored figures here given are not destitute of beauty. Again, the form of the petals is as changing as their color; so that the particular form of any of the parts of these flowers cannot either be considered as the most essential

element of their beauty. We conclude, then, that the form or *plan of the flower*, which is the same in all, is the element which above all others influences the beauty of these objects. This plan is here represented in a diagram (Fig. 54) wherein the leaves of the calyx are marked *a;* those of the corolla, *b;* the stamens, *c;* and the pistils, *d.* In this diagram the perfect *regularity* of these flowers is more easily noticed than in the drawings of the different flowers themselves; for the diagram is the flower stripped of all its specific peculiarities superposed and ingrafted upon the general plan. We see from this diagram better still than from the figure of Scilla, that the calyx does not merely consist of three equal leaves, but that they are so placed around the axis, or stalk of the flower, that they, two and two, include the same angle between them, so as to produce a triangle (*a*, *a*, *a*), the sides of which are of equal length; such a triangle is called an *equilateral* one. The same is true in regard to the next series of three leaves, *b*, *b*, *b*, constituting the corolla of the flower; but not only do the calyx and the corolla form equilateral triangles but they are so placed that the leaves of the one fall exactly midways between those of the other. If the calyx be represented by a triangle, with its vertex upward, the corolla will be a triangle with the vertex downward. But both triangles, on account of this peculiar relative position, perfectly

Fig. 54.

harmonize with one another, so as to produce a new regular form embracing them both as simply equal halves; this more general form is the regular hexagon (six-sided figure), *a b*, *a b*, *a b*, in the diagram. The reality of this hexagon is in the lilies represented by the six equal stamens, *c*. Finally, inside of these we have the pistils, three in number, corresponding in position with the corolla.

The regular hexagon, or simpler the equilateral triangle, thus constitutes the foundation of the beauty of the lilies; the form of the petals and the shape of the other parts, as well as the colors, are merely accessories, capable of heightening the beauty of the flower, but not necessary to it.

The six figures of snow-crystals (Fig. 55), selected from about two hundred different forms observed by Mr. Franke,

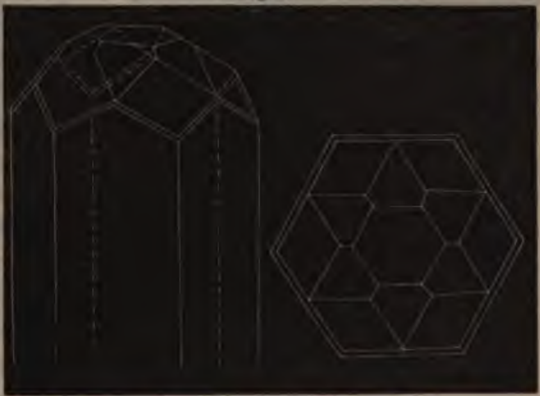
Fig. 55.

in Dresden, Saxony, in 1845–46, and published in the transactions of the society "Isis" of that city, show that the snow-crystal may rightly be termed the "lily of the sky." The first of the snow-crystals here given is almost identical with the hexagon, formed jointly by the calyx and corolla of many a lily of the field, while the second snow-crystal presents the same appearance as the six stamens of the lily. Just compare these snow-crystals with the figures of Scilla or the general diagram of the lily-flower!

The snow-crystals in the annexed figure (Fig. 56) are more common. Many of these forms may be observed on any calm winter day, when the snow falls slowly in a cold atmosphere. The lower pennate form—also taken from the plates of Franke—is particularly interesting, for it shows the six-sided star as made up of two triangular halves, the one corresponding to the corolla, the other to the calyx (outer star) of the lilies. In this same group of snow-crystals we have also three more compact forms, showing not merely the hexagonal star, principally represented by its six rays, but having the whole ground more completely filled up so as to form a regular six-sided plate. Between these and the "lilies of the rocks," the crystals found in caves and crevices deep in the earth, there is no essential difference. Compare the figure of the Emerald (Fig. 57), particularly the lower figure representing a Russian emerald, as seen from

Fig. 56.

Fig. 57.



above, with the tabular snow-crystals just referred to! It exhibits first the regular hexagonal form in its outline, and also the two regular triangles corresponding as it were to the leaves of calyx and corolla in the lilies of the field! The emerald, therefore, is built upon the same fundamental plan on which the temple of beauty is erected in the lily; but the material, though beautiful, apparently did not admit of the graceful windings exhibited in the more yielding, but also less permanent body of the lily of the field. The emerald possesses all the beauty of form and color which can be expressed by uniformity of material; and if the lily of the field surpasses the emerald in graceful modification of these forms, and in variety of color, it lacks the lustre of the emerald, and even in this very variety carries the germ of speedy decay. There are many substances which in their crystalline form exhibit the same trinity characteristic of the lily, the snow-star and the emerald. The well-known quartz, or rock-crystal, exhibits this form, and so does the beautiful mineral Alexandrite, represented in Fig. 58. This mineral was discovered in the Russian emerald diggings, on the very day on which the present emperor Alexander became of age. It has furthermore the remarkable peculiarity of appearing of a very beautiful green during the day, while in the evening (that is by lamp or gas-light) it appears of a pure red color; but red and green are the Russian colors. Hence the new mineral was named Alexandrite.

Fig. 58.

Even in the animal frame several structures have been discovered built upon the same principle, particularly the microscopic structure of the retina in the human eye. According to the discovery of the Danish microscopist, Dr.

Hannover, the interior of the eye is as if paved with very minute hexagonal blocks, put closely side by side. So also the plates covering many aquatic animals, particularly the body of many fossil crinoids, excellent figures of which may be found in the geological reports of the great American palæontologist, James Hall, of Albany. I add the figure of one plate from *Archæocidaris Agassizi*. (Fig. 59.)

Fig. 59.

It is evident from the few examples selected from among thousands, that the regular hexagonal form, or the division of the circle into three or six equal parts is a grand natural fact, alike manifest in the inorganic and organic world; this same fact is the glory and beauty of the lilies of the field, the lilies of the rocks, and the lilies of the sky.

So general a fact must be the consequence of a general law, and although this law may be deeply hidden in the mysteries of the vegetable and animal life exhibiting these forms, it may be more accessible in the lilies of inorganic, or so called inanimate nature. The question as to the cause of the form of the lily of the field may be premature, but may we not ask physical science for the cause of the form of the crystals of the rocks and of the sky? Or, to make the question still more precise, may we not ask the physicist, chemist and mineralogist—who each and every one are investigating these subjects—for the explanation of the wonderful form of the snow-crystal? That there is a cause for this form is manifest to every one who even merely glances at a few snow-crystals occasionally caught on our clothing on a winter's day; but as yet science has not been able to unravel the mysterious origin of the crystalline forms which adorn every nook and corner in the material world, and which we see forming under our very eyes in the laboratory of the chemist.

In my work called "Atomechanics, or Chemistry a Mechanics of the Panatoms," published in 1867, and distributed

among the scientific institutions at home and abroad, this question appears to be solved simply and completely. It is to be hoped that the intellectual inertia, always to be overcome by new and startling ideas, however plain and well founded, may not seriously retard the spreading of the answer to the question here raised: How is a snow-crystal built?

We cannot conclude this little sketch with more appropriate words than the description of the snow-crystal given by Prof. Tyndall, in his fourth lecture of the admirable work, "Heat as a mode of motion." The great philosopher of the Royal Institution says:

"Snow, perfectly formed, is not an irregular aggregate of ice-particles; in a calm atmosphere the aqueous atoms arrange themselves so as to form the most exquisite figures. [See the figures given in the preceding parts of this article.] The snow-crystals formed in a calm atmosphere are built upon the same type: the molecules arrange themselves to form hexagonal stars. From a central nucleus shoot six spiculæ, every two of which are separated by an angle of 60°. From these central ribs smaller spiculæ shoot right and left, with unerring fidelity to the angle 60°, and from these again other smaller ones diverge at the same angle. The six-leaved blossoms assume the most wonderful variety of form: their tracery is of the finest frozen gauze, and round about their corners other rosettes of smaller dimensions often cling. Beauty is superposed upon beauty, as if nature once committed to her task took delight in showing, even within the narrowest limits, the wealth of her resources."

ON THE PRESERVATION OF ENTOMOLOGICAL CABINETS.

BY JOHN L. LECONTE, M. D.

I HAVE tried at various times many experiments for the preservation of collections of insects, but with such limited success that I did not think the results obtained worth publishing. For the sake of deterring others from pursuing these different lines of unsuccessful attempts, it would be useful, perhaps, to give a brief account of my failures before describing a process recently devised, which seems to be both simple and effective.

Corrosive sublimate and various preparations of arsenic have been recommended by several high authorities. The former, even when most diluted, will finally render the pin brittle by the amalgam developed; the latter, when used in a very weak alcoholic solution so as to leave no efflorescence on the specimens, will preserve them well, but is troublesome to apply, as the insects must be thoroughly soaked with the fluid before being placed in the cabinet. Binarseniate of potassa being deliquescent, suggested itself to me as a material that might be applied in greater strength, and many years ago I prepared two boxes of specimens with it. They had a good appearance for some time, and have never been attacked, but eventually a considerable deposit or efflorescence came on the surface, so that the specimens required cleaning before they could be used for study.

Painting the interior of the boxes with arsenious acid was also only partially successful; I have seen, though not often, living larvæ of *Trogoderma* in boxes thus prepared.

Having thus failed in finding any satisfactory mineral poison I then tried the vegetable alkaloids.

I soaked specimens in moderately strong alcoholic solutions of strychnia and picrotoxia, dried them, and put them

into pill boxes with *Trogoderma* larvæ. After some weeks the specimens were partly eaten, and the larvæ transformed into perfect insects.

The effects of benzine and carbolic acid are powerful, but only temporary. The former is preferable on account of its less disagreeable odor, and may be used by pouring about a teaspoonful in each box; it must be renewed every four or five months.

Packing the collection in chests painted with coal-tar has been also recommended, and would certainly be efficient, but troublesome, and renders the collection, practically, nearly useless for study on account of the difficulty of access to the boxes. Surgical art has, however, given to us an instrument by which a poisonous liquid can be rapidly and most effectively applied to the entire surface of large numbers of specimens as they stand in the cabinet boxes, without the trouble of moving them. I refer to the *Atomizer*.

Opinions may vary as to the nature of the liquid poison to be used, but after several trials I have found the following formula to be quite satisfactory; it produces no efflorescence, even on the most highly polished species, while the odor is quite strong, and persistent enough to destroy any larvæ or eggs that may be already in the box:—

Saturated alcoholic solution of arsenious acid, eight fluid ounces; Strychnine, twelve grains; Crystallized carbolic acid, one drachm; Mineral naphtha (or heavy benzine) and strong alcohol, enough to make one quart.

I have not stated the quantity of naphtha, since there are some varieties of light petroleum in commerce which dissolve in alcohol only to a slight extent. These should not be used. The heavier oils which mix indefinitely with alcohol are the proper ones, and for the two pints of mixture ten to twelve fluid ounces of the naphtha will be sufficient.

Care should be taken to test the naphtha on a piece of paper. If it leaves a greasy stain which does not disappear after a few hours, it is not suitable for this purpose.

The best form of atomizer is the long, plated, reversible tube; it should be worked with a gum elastic pipe, having two bulbs to secure uniformity in the current. The atomizing glass tubes and the bottle which usually accompany the apparatus are unnecessary: a common narrow-necked two ounce bottle will serve perfectly to hold the fluid.

I trust that the use of the means here indicated may render the preservation of insect collections less troublesome than heretofore, and thus increase the interest of amateurs who frequently become disgusted with the science of entomology, by seeing the results of years of active and intelligent labor destroyed by a few months of inattention, or by carelessness in introducing infected specimens.

A TRUE STORY OF A PET BIRD.*

BY ROBERT RIDGEWAY.

WHILE attached, during the past year, in Nevada, to the U. S. Geological Exploration of the Fortieth Parallel, under Mr. Clarence King, I had a pet bird of the species known as the Arkansas Flycatcher (*Tyrannus verticalis*), which is closely related to the common Kingbird or Bee Martin in form, but differs in having the back olive gray, and the under parts yellow, except the throat, which is ashy. It is to be met with over the entire western portion of the United States, from the high plains west of the Missouri River to the Pacific, and in the vicinity of settlements is well known to every one.

Our pet, familiarly known to the party as "Chippy," was obtained about the middle of July, from the Indians, who had just taken it with three others, all fully fledged, from the nest. We carried it to our camp near by, and fed it with

* Communicated by the Smithsonian Institution.

grasshoppers and flies until he was able to catch them for himself, which he learned to do about a week after he could fly. The little fellow appeared to be always hungry, and during the day followed me about, continually teasing me for grasshoppers until he had eaten enough, after which he would remain quietly upon my shoulder, or my hat, or fly off to his favorite perch—a rope running from the top of the tent to a stake in the ground. At night "Chippy" roosted upon a rope inside the tent, or frequently under an umbrella, which, for the purpose of shading a thermometer, hung at the corner outside. When wishing to go to sleep, however, he would seldom roost in these places voluntarily, but alighting upon my shoulder would hop up close to my neck and settle cosily down, and repeated removals were necessary to induce him to remain upon the perch provided for him. In the morning as I lay wrapped in my blankets, generally the first thing that awoke me would be Chippy fluttering about my head, for he would invariably select me from the dozen persons who lay around upon the ground.

Chippy soon became a general favorite, and every one fed and caressed him. First among his many peculiarities was his almost insatiable appetite, which excited the greatest wonder and comment, and many were the conjectures as to the number of good-sized grasshoppers he could dispose of in one day. It was finally agreed that this should be settled by an experiment; each person was to keep account of all he fed Chippy, and in the evening, upon comparing notes, it was found that during the day he had made away with the almost incredible number of one hundred and twenty fat grasshoppers, all however, with their legs pulled off.

Our little pet possessed scarcely a trace of timidity, and even soon learned his own name. At least, when he was wanted we had but to call "Chippy, Chippy," and he immediately appeared, even if out of our sight, joyously twittering as he approached, and alighting upon the shoulder of the person who called him. He soon began to catch insects

himself, after I had taught him by carrying him around upon my finger and placing him up close to any fly or gnat I found perched upon the wall of the tent. When fully grown he passed most of the day sitting upon the top of the tents, occasionally darting after a passing insect, or, if the weather was particularly warm, perching upon the edge of the table, or any suitable place, under the "fly" of the tent, in the shade.

Once, when starting on horseback up the mountains after birds, at about one hundred yards from camp, I was surprised to hear Chippy coming towards me, playfully twittering, when he alighted upon my shoulder and accompanied me up the cañon. Occasionally he would leave me to catch a butterfly or other insect, upon securing which he immediately returned, alighting upon my hat, against which he beat the captive until in a condition to be swallowed. Frequently on seeing other birds of his species, he would join them, and after sporting with them awhile return to his seat upon the pummel of the saddle, my shoulder or hat, his playmates following to within a few yards, when they would stop, and perching upon a dead branch curiously watch us, wondering probably why their little friend was so fearless of me. Chippy accompanied me thus some three or four miles from camp. Having proceeded as far up the cañon as possible, I there tied and unsaddled my horse; the sun being very hot, and the bird disposed to be inactive, I placed him in the shade of my saddle. I then climbed up the hillside over the rocks, until out of sight of my horse, on my way occasionally shooting a bird, and wandering some distance from where I left Chippy; but upon my return I found him following after me, having discovered my absence by the report of my gun, and started in search of me. We then returned to camp as we had left it.

Our pet bird soon began to attract others of his species to the camp which became quite familiar. They could not, however, persuade Chippy to leave us, he evidently preferring

our society to theirs. He was at first perfectly unmindful of the report of a gun, even sitting upon my shoulder when I fired, or often perching upon the gun-barrel when I carried him with me in my rambles. One day, however, wishing to secure one of these flycatchers which flew about our camp, and intending if possible to drive them away, I shot at one of three which were sporting together in the air, thinking that Chippy was sitting upon the tent; fortunately I missed the bird I shot at, which proved to be our pet, he flying in great consternation to the camp, having probably been touched by one of the shot, although not at all injured. His disregard for a gun was now at an end, and the mere picking up of this instrument of death was sufficient to cause his immediate retreat, retiring with terror depicted upon his countenance, the feathers lying close to his body, his crest elevated and neck outstretched, removing to another perch each time I advanced. The moment, however, I laid the gun aside, all his fears were over, and upon approaching him, when I reached out my hand he would hop upon my finger with perfect confidence. Although I might carry him in this way all about the camp, if I approached the gun, which leaned against the tent, he made a precipitate retreat.

We carried Chippy with us, from camp to camp, for nearly two months longer. Everywhere we went he excited the curiosity and wonder of all persons, the Indians included, and we had not the least fear of losing him. One morning, however, in the latter part of September, we missed his familiar awakening twitter, and when we arose from our blankets he could not be found. Search was made throughout the day but without success, and a large hawk having been seen early in the morning hovering about the camp seemed to explain the cause of his disappearance. He was never afterwards seen.

WHAT IS A DESMID?

BY PROF. ARTHUR MEAD EDWARDS.

IN the language of science, as put upon paper by one of its most zealous devotees, Desmids, or as they are more correctly designated, Desmidiaceæ, are "fresh-water, figured, mucous and microscopic algæ, of a green color." This author also tells us in similar language that the characteristics of these fresh-water forms are "transverse division mostly complete, but in some genera incomplete. Cells or joints of two symmetrical valves, the junction always marked by the division of the endochrome, often also by a constriction. Sporangia formed by the coupling of the cells and union of their contents."

We have here then, in brief, what a Desmid is, and now let us see if we can make this very concise, scientific and correct definition and reply to our question, plain to unscientific minds.

The difficulties attendant upon the study of these Desmids have perhaps, tended to frighten away even professed naturalists from a field of enquiry teeming with promise of results of the greatest interest and profit. At least then we have arrived at the knowledge of one fact, and that is, that a Desmid is a plant, or a member of the vegetable kingdom. This point, it is true, is all but universally acknowledged by every one who pretends to any acquaintance whatever with these creations, and therefore for the time being we will take it for granted that such is the case. In fact it is true that there is no one essential point in which they differ from the other minute plants which have been included under the designation of Protophytes; this name having been applied to them on account of the simplicity of their structure, ranking them as *first plants* in the vegetable system. But, although the name Protophyte was first bestowed for this

reason alone, there seems to be good grounds for supposing that it has been very aptly applied, for naturalists are strongly of opinion that the first forms of vegetable life which made their appearance upon the surface of the globe belonged to this group, and we see them at the present day occurring as the harbingers of more complex plants in pools and ponds, on rocks and by road-sides. The amount of study that has been bestowed upon the Desmids is really very great, but it has been by a special class of observers who have been in the habit of not trusting to the revelations of their unassisted eyes, but have called in the aid of all the contrivances of modern mechanical skill as embodied in that perfect instrument of research, the achromatic microscope. By such students we are assured that in no respect do they really approach the animal kingdom. Many arguments, it is true, have been from time to time advanced in support of their animal affinities, but these have all been determined, now that their life history and that of many other undoubted and undisputed plants have been better understood, to be but strongly indicative of their vegetable nature. But the very fact that for a long time they continued to be bandied from one kingdom to the other, now plants and then animals, only to become plants again, indicates the difficulties attendant upon their study, and the uncertain tenure with which they, even now, hold the position they by courtesy are permitted to occupy.

Ehrenberg, the great German microscopist, asserted that one of the Desmids, known by the name of Closterium, possesses true organs of motion, which it protrudes through apertures in its extremities, and keeps in continual action. Unfortunately, however, more recent investigation has revealed the fact that this statement is wanting in accuracy. No such organs of propulsion are to be seen now that we are possessed of much better microscopes than the Prussian philosopher was wont to use, therefore we can but ascribe the "feet" of his Closterium to defective methods

of observation. Many if not all of the Desmids, it is true, possess the extraordinary power of slowly changing their place, so that in time, varying with the particular forms observed, they approach the side of the bottle in which they are enclosed, upon which the most light shines, and not only so, but many appear to have a continual but steady progressive mode of motion, as when viewed by means of the microscope they are observed to traverse the field of view under the eye of the observer. Yet it cannot be said that this faculty allies them to animals, for not only do the seeds and similar parts of many plants move about in an extremely vigorous manner, but many undoubted Protophytes do so likewise. Motion is not and cannot at the present day be considered as indicative of aught else but change, physical or chemical, else might a grain of gum-camphor darting about upon the surface of a glass of water, be classed among vital organisms.

Doubtless many persons who see the question placed at the head of this article have noticed some bright pool of fresh water, by the road-side or in a field, upon a spring or summer's day, and observed that it was either filled with a seemingly gelatinous mass of light green matter, or had patches of darker green floating upon its surface. This was an indication that Protophytes or simple plants were present, and, although there are chances that such an accumulation of vegetation contains, or even entirely consists of, other organisms, yet in a number of cases hardly anything but Desmids will be there found. To collect these little wonders we have various methods suited to their mode of occurrence, and it will be well to indicate them.

First, then, they are inhabitants of fresh water, and in fact of the freshest kind of water only, decaying animal matter which would cause the water to become foul, even in a very slight degree, being sufficient to kill these tender plants and cause them to be replaced by forms of much greater simplicity. Certain brackish and marine organisms, which were

at one time supposed to belong to this family, have been since proved not to be members of it. It has been said that hardly a specimen of fresh water can be found that does not serve as the habitation of Desmids, but such is not strictly the case, although it is true that they are very widely distributed, and one intending to study them should have no difficulty in procuring specimens for examination. In clear pools, in open exposed situations, they occur in the greatest abundance, the largest species being generally found nearest the bottom. Sometimes they are to be found adhering in large quantities to some of the submerged aquatic plants that grow in such localities, forming investing films of a bright green color, which can be removed from its support, or is best gathered along with it. At other times they rest as a thick coating upon the bottom, or float in the form of a bright green scum upon the surface; but the last mode of occurrence is by no means common, the green-colored film seen so frequent upon pools not being Desmids but members of a group into which have been placed the Protococcus, Euglenia, and the so-called "Red-snow." Of these we may have something farther to say hereafter, as they are possessed of wondrous characteristics, and present subjects well worthy the study of any one having a microscope. The brownish scum which is so commonly seen in marshes and ponds does not consist of Desmids either, but is mostly made up of myriads of plants very nearly related to them, and familiarly known as Diatoms. These, again, are of extreme beauty, and at the present day hundreds of microscopes are turned towards them endeavoring to fathom their mysteries, and the optician's skill has been brought to bear upon the construction of lenses specially for the purpose of studying their life, history, and structure.

The Desmids, *Desmidieæ*, or, more correctly speaking, *Desmidiaceæ*, have had this designation applied to them from their form, that is to say, on account of their being made up of two symmetrical halves, united together by

means of a band or bridge, so to speak. They are very striking and beautiful objects when examined by means of sufficiently powerful magnifying glasses, many of them requiring for the elucidation of their structure to be amplified at least five hundred diameters, or two hundred and fifty thousand times superficially; microscopists being in the habit of speaking of the magnification of an object in diameters, that having been found to be the most convenient method of expressing the fact, the number of times which the object is amplified superficially, being, of course, formed by squaring the diameter. But a power much less than five hundred diameters, say about two hundred and fifty, is often sufficient to exhibit the general characteristics of most of the Desmids and their allies, the other Protophyta. Thus examined they present most striking objects, and at once become favorites with the amateur microscopist on account of their very marked peculiarities, great beauty, and the variety of forms which they exhibit in outline, as well as the mathematical symmetry of their markings and appendages. The most distinctive characteristic which they at once present is the bilateral structure of their so-called fronds. In the more complex water-plants, or algæ, the term frond is used to designate the whole plant, which in that case is of some degree of complexity, but here is extremely simple, and yet the same name must be made use of, as the entire individual is enclosed in one envelope and constitutes but a single cavity. As such cavities are called cells the Desmids are hence known as unicellular plants. The individual plant among the Desmids and their near relatives, the Diatoms, is often spoken of as a frustule, as the frustule of Closterium, a frustule of Navicula, these being the distinctive names given to two groups, or genera, of Desmids and Diatoms respectively. So in the organisms under consideration, the frustule is said to be a single cell, and this is shown to be the case by the fact that when a fracture takes place of the investing membrane, at any one part, the whole

contents escape therefrom. In a few instances this apparent bilateral symmetry is not so evident as in others, or even seems to be entirely absent, but on careful examination it will still be seen to be present, for the constriction in the outer coat, which is made of the substance called cellulose, may be slight or very great, cutting the individual, as it were, into two parts. External warty or spinous protuberances, or processes, are very commonly present, and then the outline of the plant is of great beauty, the green cell-contents, made up for the most part of the same material as constitutes the coloring matter of the leaves of larger plants, and there called chlorophyl, but in the Desmids known as endochrome, causing them to appear almost like brilliant gems of great purity of tint and configuration. In some cases no such external projections are present, but yet the outline of the cell is, nevertheless, extremely graceful. In the Diatoms the cell-wall is strengthened and supported by having deposited within it a mass of silicious material which then becomes marked with wonderfully fine tracings and sculpturings, but in the Desmids no such stony and indestructible substance is present, stiff cellulose only constituting the skeleton of the plant. Hence we do not find the remains of these organisms occurring fossilized in the older strata of the globe as is very commonly the case with the Diatoms. It is true that in some of the flints, hornstones and cherts, certain curious forms have been detected which have been supposed to be the remains of Desmids, but careful examination by competent authorities has tended to prove that such is not the case, but that these are most likely only the skeletons of animals very nearly allied to, if not identical with, the sponges. The true cellulose character of the cell-wall of the Desmids is proved by the action upon it of iodine assisted by sulphuric acid, in which case it is colored blue. In all cases this tough membranous material is surrounded by a perfect and distinct, although not always readily seen, sheath of a gelatinous character, which

in some cases, is very broad, but in others is extremely thin.

The outline of the Desmids, although always preserving a more or less perfect bilateral symmetry, varies very greatly. Thus in Closterium, a genus of very general distribution, and one at the same time which includes a great number of species, the general form is a round tube, more or less pointed at both ends, and with the apices both bent over in the same direction so that the individual is somewhat moon-shaped, or more like two cows' horns united base to base. When Closterium is examined with care by means of a good microscope, it is found to have its bright green cell-contents arranged longitudinally in seeming uncertain bands, which coalesce more or less, and hence are not always to be distinguished. But at the ends of the frustule are to be seen apparent organs of wondrous characters, and whose office has not as yet been determined. And the extreme minuteness of the whole plant presents great difficulties to its proper study, so that it is hardly to be wondered at that the functions of its integral parts should not be thoroughly comprehended. These seeming organs are spaces or vacuoles separated from the rest of the cell-contents, and generally of a spherical form, transparent and colorless. Within them, however, are observed numerous minute granules formed of a material of different density, as is shown by their effect upon light. And these are continually, in the healthy individual, in motion, moving about with a trembling and seemingly excited action, putting one in mind of the swarming of a crowd of bees, and hence it is often spoken of as swarming. Besides this, however, there is still another kind of motion to be seen within the Closterium cell-wall, and one at the same time perhaps of greater wonder and perplexity than that already mentioned, as the mode of motion is a problem as yet unsolved. This is the circulation or rotation of much of the liquid contents of the individual Desmid; more especially that transparent and color-

less portion which lies just within the membranous cell-wall and its lining tissue, called by the German naturalists the primordial utricle, and overlying the more solid green mass of endochrome and starchy matter; for it has been found that these wonderful little plants contain starchy matter very much after the manner of their gigantic fellows of the field and forest. Members of the genus Closterium have been found to afford the best subjects for witnessing this phenomenon, but the use of a good microscope, and a very careful arrangement of the focus of the lens, are always necessary to display it in a manner at all satisfactory. Some observers assert that they have observed this circulation of fluid, not only within the primordial utricle, but between it and the cellulose covering; however this must be a difficult thing to see, as these membranes are very closely united in most cases. Along the convex edges of the cell, when a magnifying power of about four hundred diameters is employed, it is not very difficult to see indications of this, what may be called "sap-motion" first spoken of, especially if the specimen under examination be one in a vigorous state of growth. Then there may be seen broad streams of fluid flowing over the whole surface of the endochrome, passing from the ends towards the centre and back again; and these streams seem to detach and carry with them, from time to time, little oval or globular bodies, which, on account of their action upon the light, doubtless resulting from their peculiar chemical composition, are readily seen, and any of them may be singled out and its whole course from one part of the frustule to another traced. Some observers state that these minute granules, which seem to be starchy in their composition, are thus carried on to the chambers or cavities at the end of the Closterium, and there join the bodies which are in trembling motion, as has been described; but my experience has been that such is not the case, as the number of the terminal granules does not increase, as would certainly be the case if this addition took place. On the contrary I

have often watched a single such granule caught in and carried along by the current of the flowing sap, up towards the cavity at the end, and down again towards the centre, which it reached only to again pass on up, or was arrested in its course and stopped by the way. Again I have often observed that whilst these granules were in themselves passive, and appeared to be but carried along by the stream, and were at the same time all but colorless, the uneasy little dots at the ends of the frustule were in themselves motive, and usually more or less colored, generally of a light brown tint. However this may not be always the case as we cannot, for certain, reason as to what would take place under particular circumstances in the vegetable kingdom, from what we see occurring during the prevalence of peculiar conditions. The current within individuals of Closterium, and its allied genus Penium, as they have been observed by me, would seem to be from the middle towards the ends externally, or against the primordial utricle, and then turning upon itself down again beneath or interiorly against the mass of endochrome in and along the lighter colored interspaces of that mass, which cause it to assume the coarsely banded appearance so very commonly to be seen.

One observer, named Osborne, has thought that this circulation of fluid within the Desmids—for it is by no means peculiar to Closterium or even Penium, but can be observed in several genera, although not so markedly as in these two—is caused by the waving about of little hairs, or ciliæ, as they are called, from their resemblance to eyelashes, set upon the frustule both within and without its cell-wall; but hardly any one else has been able to see any such ciliæ, and an excellent authority upon the microscope, Dr. Carpenter, says, "although the circulation is an unquestionable fact, yet I have no hesitation in regarding the appearance of ciliary action as an optical illusion due to the play of the peculiar light employed among the moving particles of the fluid; the appearance which has been thus in-

terpreted being producible at will by a particular adjustment of the illumination, but being undiscoverable when the greatest care is taken to avoid sources of fallacy." Mr. Osborne also thought he had detected external apertures in the cell-wall of Closterium, at about the locality where Ehrenberg had placed his "prehensile organs," or "feet," which, of course, were necessarily present, whilst he considered the Desmids as animals. Dr. Carpenter says with regard to this, "I must confess to a similar scepticism respecting the external apertures said by Mr. Osborne to exist at the extremities of Closterium; for whilst their existence is highly improbable on *a priori* ground, Mr. Wenham (than whom no observer is entitled to more credit) states that 'not the slightest break can be discovered in the laminated structure that the thickened ends display.'" My observations coincide exactly with those of the last gentlemen, and in fact the same is the opinion of all competent and unprejudiced observers at the present day. Most, if not all the Desmids, have the power of changing their place by sailing, slowly it is true, through the water, though not exhibiting the liveliness so evident in the Diatoms. But that they do move can be shown by shaking them up with some mud, and then covering them with water in a saucer, and placing them where the direct sunlight, or even light reflected from the sky, can fall upon the surface, when, after a time, it will be seen to become green, and the Desmids are found to have congregated at the point nearest the light; in this respect exhibiting their vegetable nature, for we know that plants love the light and will tend towards it whenever they can do so.

An individual of Closterium is represented in Plate 5, fig. 10, and the vacuoles at the ends containing the motile granules are there seen, as well as indications of the circulation of the cell-contents spoken of. The mode of growth and reproduction of the Desmids are very remarkable and of great interest, but we must leave the consideration of

them to some future time, only now referring to our plate, where several forms of these beautiful plants are represented illustrating the grace and symmetry exhibited in these simple organisms.

EXPLANATION OF PLATE 5.

Fig. 1. *Closterium*, conjugating.
Fig. 2. *Desmidium*, side view.
Fig. 3. *Desmidium*, front view.
Fig. 4. *Cosmarium*.
Fig. 5. *Cosmarium*, conjugating, and forming a Sporangium resembling the so called Xanthidia found in flints.
Fig. 6. *Micrasterias*, subdividing or growing.
Fig. 7. *Micrasterias*, subdividing or growing.
Fig. 8. *Staurastrum*.
Fig. 9. *Pediastrum*.
Fig. 10. *Closterium*.

REVIEWS.

The Harris Correspondence.* — Well do we remember the delight and lively interest we felt when for the first time we were allowed to look over the Harris manuscripts, after they came into the possession of the Boston Society of Natural History. There were files of letters from Curtis, Doubleday, Hentz, Leconte and Herrick, with notes from entomologists of greater celebrity, and others of lesser fame, with a number of manuscript books filled with long extracts from the works of Godart, Latreille and Olivier, in the concise and beautiful handwriting of this painstaking and precise man; copies of his own letters to his correspondents, illustrated with occasional pen and ink sketches, often of unusual fidelity and finish, of which we have fac-similes in the work before us, and three volumes of drawings, plain and colored, often made with great care, — all evidences of great industry and ability, and of the highest interest to a young naturalist away from instructors of eminence, as showing the methods of studying natural history, — being the chips, models and half-finished undertakings of a working naturalist. Such is the Harris Correspondence, and we have said nothing of the qualities of heart, the geniality, strong human sympathies and undying love of nature that crop out in the letters, published and unpublished, of one who, all in all, must rank as the first among American entomologists.

In this very attractive volume, adorned with an excellent portrait on

*Entomological Correspondence of T. W. Harris, M. D. Edited by S. H. Scudder. Occasional Papers of the Boston Society of Natural History. I. Boston, 1869. 8vo, pp. 375, $5,00. To be had of the Naturalist's Book Agency.

steel, and four steel plates of moths, caterpillars, beetles and their larvæ, with forty-six cuts in the text, we first open upon a memoir of Dr. Harris, by Col. T. W. Higginson. Then follows Harris' Correspondence with Hentz, Melsheimer, Doubleday, Herrick, Leconte, Miss Morris, and shorter communications from Say, Zimmerman, and others. An Appendix contains numerous descriptions of larvæ, republished papers, his contributions to entomology in the "New England Farmer," extracts from agricultural papers, etc., etc. The work is beautifully printed, edited with the greatest care and fidelity to the memory and fame of Dr. Harris, and is a work that every one who wishes to be an entomologist should read and reread, that he may imbibe the spirit of conscientious research and unwearying devotion to truth that were among the prime characteristics of Dr. Harris' nature.

Pictures and Stories of Animals.* —These works will unquestionably prove of benefit to the young. They are not so praiseworthy in point of composition as in the amount of information which they contain. The illustrations are most of them characteristic, while others have that stiff, woodeny appearance but too often found in works upon Natural History. The Tenney series, unlike all other juvenile works of its class, treats principally of American animals, and for that reason, if for no other, we heartily recommend it to those who would instruct their children or younger pupils in the rudiments of Natural History.

Fishing in American Waters.† —That Genial is the nature if not the exact name of the author of this most useful and entertaining volume must be apparent to every reader. Fun and fishing, tackle and tattle, pisciculture and porgies, are sandwiched together in a most delightful manner throughout the entire work. The author is evidently a Waltonian angler, an "honest man who fears God, loves his neighbor, and goes a fishing."

A fly-fisher, and, as is well known a master of that gentle art, he does not, as has been lately the fashion, "wash his hands of such dirty things" as worms, grubs and flies, and affect to despise those who use them as Goths and Vandals, but honestly acknowledges that skill may be displayed even in bait-fishing, and gives the results of his experience in that line for the benefit of those benighted heathens, who, as yet, may be totally innocent of any knowledge of the hackle, palmer, or coachman.

The Natural History department of the book is, however, to say the least, somewhat curious, as witness the following:

"I may also state my conviction that a whale is a fish, and that the porpoise is also a fish, though the members of this *genus* travel in pairs, suckle their young, of which they usually have but one at a birth, which the parent mammal guards with jealous care." (p. 25.)

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*Pictures and Stories of Animals for the Little Ones at Home. By Mrs. Sanborn Tenney. Six Vols., 12mo. Sheldon & Co., New York.

†Fishing in American Waters. By Genio C. Scott. New York: Harper & Brothers. 1869. 8vo,.pp. 484.

Again (p. 41) he gives us an entirely new scientific classification of the fishes as follows: First, Mammalia!!!! Second, the genus Salmo. Third, all other oviparous fishes.

Again (p. 353), "Spallanzani proved the possibility of impregnating the eggs of *fishes* artificially. He took the eggs of a *frog* and impregnated them with the semen of a male *frog*." Surely all is fish which comes to Mr. Scott's net, Mammals and Batrachians included.

The section on Fish Culture, occupying sixty-two pages, is valuable and interesting, though written apparently more for the purpose of satisfying curiosity than of giving information to the working pisciculturist, who is anxiously looking for some work in the English language (any other will be thankfully received, but English preferred) which will give full and accurate directions for the artificial propagation of fishes. Coste, Haxo, Shaw, Boccius, Francis, Præd, Garlick, Fry, and even Norris, leave much to be desired.

Of the pictorial embellishments a great deal may be said on both sides. The grotesque initial letters are capital, the figures of fishes, taken for the most part from a well-known school-book, are very poor and by no means new; with half a dozen exceptions those in the back part of the book are intended to represent European species, and the others are with one or two exceptions, so uncharacteristic and inaccurate in detail (*e. g.*, a smelt without the adipose dorsal, p. 102, etc.), as to render the name under the cut a very important appendage. The fishing scenes are decidedly below par. On page 391 is a cut which has been going the rounds of the periodical press for the past year, and which we had hoped was, ere this, worn out. It has appeared successively in "Harper's Weekly" and "Monthly," "Scientific American," and "Phrenological Magazine." It represents a poor martyr trout in the hands of an unskilful manipulator, who holds her in such an outre manner, and squeezes her so tightly, that the eggs are forced out at the wrong way. A view of a much more humane and profitable method of handling trout may be seen on the frontispiece of "Francis' Fish Culture."

A statement like that of the capture of *Turbot* on the coast of New Brunswick (p. 432), must be taken with full allowance as to what is intended by the name of *Turbot*.

But with these exceptions, and as far as is promised, the book is the best that has yet been issued. To give instructions for fishing in American waters is what is promised in the title, and this is faithfully carried out, and to use a new and strikingly original phrase, no library of works on Angling can be complete without it. — TRUTTA.

THE MISSISSIPPI VALLEY.* — "It was with a view," the author states in his preface, "of illustrating the gradations between the forest, prairie, and desert; the varying conditions of temperature and moisture, and

* The Mississippi Valley: its Physical Geography, including sketches of the Topography, Botany, Climate, Geology, and Mineral Resources; and of the Progress of Development in Population and Material Wealth. By J. W. Foster, LL. D. Illustrated by maps and sections. Chicago: S. C. Griggs & Co. 1869. 8vo, pp. 443. $3.50.

their effects in determining the range of those plants cultivated for food; and, at the same time to trace the character of the fundamental rocks over the whole of this region, pointing out the mode of occurrence of those ores and minerals useful in the arts; and, finally to trace the colonization of this region from its feeble beginnings to its present magnificent proportions, that this work was undertaken." The author does not confine the attention of the reader to the physical features of the Mississippi Valley alone, but carries him away over the Rocky Mountains down the Pacific slope, and up the Valley of the St. Lawrence, and devotes an entire chapter to the *llanos* and pampas of South America and the steppes and deserts of Asia, Africa, and Australia. We have in this very readable volume the most recent and comprehensive account of the Great Valley of the West that has been published in a popular form. The chapters on the origin of prairies and the geological features of the region drained by the Mississippi are exceedingly interesting, and by their clear presentation of facts, with which the author has familiarized himself while engaged upon Government surveys and in private research, are well calculated to give the general reader a good idea of the formation of our continent, and the origin of the grand features which go very far in determining the physical and moral condition of the nations dwelling on its surface.

NATURAL HISTORY MISCELLANY.

BOTANY.

TABLE MOUNTAIN PINE. — There seems to exist [illegible] opinion [illegible] in regard to the geographical [illegible] *P*[illegible] M[illegible] that we have thought a statement [illegible] [illegible]

M[illegible] [illegible] west of [illegible] [illegible] Pennsylvania [illegible] [illegible] M[illegible]

[illegible] Prof. Porter [illegible] [illegible] of these limits [illegible] [illegible] tree is in Pennsylvania. Thus far I have found it ranging from the banks of the Juniata River, in Mi[illegible] County,

Pa., to Penn's Valley, in Centre County, Pa. In the latter place it is extremely common, and often forms the largest portion of the woods. The trees, too, attain a height of fifty, and perhaps I may add, not seldom sixty feet.

Mr. Hoopes, in his "Book of Evergreens," has given an admirable representation of one of the *characteristic* cones. Here I would state that the strong spine which tips each scale is subject to a most remarkable variation in size; sometimes dwindling down until it is less than in *Pinus rigida*. I have even seen this variation, from the real typical spine to the dwarfed one, on well formed scales of the same cone. We may recognize the tree usually at a glance by the persistent whorls of large cones. — J. T. ROTHROCK.

VARIATION IN THE SARRACENIA. — Mr. Wm. H. Silsbee, of this city, has brought in from the woods in Beverly, a variety of *Sarracenia purpurea* Linn., which is worthy of notice. The modification is chiefly in color, though the size of the flower, judging from the specimen examined, is rather less than the average of the common kind. The deep purple usually seen is wholly wanting; the scape, sepals and stigma, being of a light apple green, while the petals have taken on a decided, though rather pale yellow. The leaves were not collected, and whether any change is found in them does not yet appear. This would seem a case of albinism, nearly parallel with that in *Aquilegia Canadensis* Linn., reported some years ago by Mr. G. D. Phippen, of Salem. It is an interesting question whether, in the case of deep-colored flowers like these, there is a tendency, when passing into the albino state, to stop the process at the yellow tints, as a sort of intermediate point, and not carry it forward to full whiteness. Farther observation is highly desirable; and we learn that Mr. Silsbee is acquainted with several spots where this variety of the *Sarracenia* is found. — C. M. TRACY.

DOUBLE EARLY SAXIFRAGE. — This beautiful variety of the *Saxifraga Virginiensis* has been detected again by John H. Sears, in a new locality near Beverly Bridge. The panicle is smaller than in the normal form, but each flower is full-double to the very centre, the change obliterating every trace of stamen and pistil, and the blossoms remind one of those of the Queen of the Meadow (*Spiræa*), such as we see it in the gardens. — J. L. RUSSELL, *Salem*.

COREMA CONRADI (Torrey). — This plant, which occurs in Newfoundland and on some of the islands off the coast of Maine, also on Cape Cod, near Plymouth, was found many years ago at Cedar Bridge, Ocean County, N. J., by Prof. S. W. Conrad, of Philadelphia. It was carefully described by Dr. Torrey in 1837 (in the Annals of the New York Lyceum of Natural History, Vol. iv, p. 83) under the name of *Empetrum Conradi*, and its New Jersey localities accurately indicated. A visit to Cedar Bridge, made in April of this year by the writer and C. F. Parker, of Camden, N. J., showed that the plant has entirely disappeared from that locality. It is said to have been also found at Pemberton Mills, N. J.,

but from that point it has been banished by agricultural encroachments. There is therefore no evidence that this species now exists south of Cape Cod, though it is possible it may again be found in New Jersey, and if anywhere in that State, probably on the wide stretch of barren, sandy dunes, a few miles west of Cedar Bridge, locally known as "The Plains," extending along the border between Burlington and Ocean Counties. Long Island should also offer some favorable points for its occurrence. —J. H. REDFIELD, *Philadelphia.*

FRAGARIA GILLMANI.—In the NATURALIST (p. 221) Judge Clinton describes a new Fragaria, from Mexico. With specimens before me, it is clearly nothing but *Fragaria vesca* Linn. *F. vesca* is a very variable plant. It is found not only all over Europe but through the whole mountain range of the American continent to the south of Mexico, and probably beyond. The higher the range the greater is the tendency to a racemose, and an "everbearing" character. I have in my herbarium specimens collected even in the comparatively low elevation of the Alleghanies in Pennsylvania, that are not in the slightest degree different from this Mexican one.

It might not be amiss to describers of species to suggest that greater attention be given to natural variations. Great evil has resulted to Botany from attributing to Horticulture so many great changes that are really but the regular developments of natural law. I have given particular attention to the strawberry for over twenty years, and am sure that "hybridization and the gardener's skill" in the production of varieties are pure imagination. The gardener has preserved, but he has not originated variations. I have not had the opportunity of examining Schleactendals' *S. Mexicana*, and some other of these so called species but from what I have gathered of the law of variation in Fragaria, and the direction of that law in the numerous forms of Fragaria that I have examined, I have little doubt that they are forms of one thing. Indeed, with the exception of *F. Indica*, there is every probability that all the species of strawberry are closely related forms of one another.

One law in strawberry development which has been of great service to me is that the "runner," or stolon, is but a modified "flower stalk," or peduncle, bearing along its course viviparous buds, instead of flowers. The grades between the forms of this one thing—that is, the vigorous runner and the floriferous scape—are beautifully illustrated by selecting the most floriferous forms (*F. semperflorens* of Duchesne), and the more vigorously running kinds (*F. Illinoensis* Gray). In *F. semperflorens* (*F. Gillmani* Clinton), the plant sometimes produces no stolons, but when it does *flowers will frequently come out at the nodes*, and the singular appearance is presented of a few single-flowered peduncles with a couple of leafy bracts, sending out roots as a living plant. When it does not produce stolons, the number of flower spikes is increased, and as they cannot "run," as a stolon, make up for this by continual axial production, bearing a succession of flowers through the whole season. By

watching a bed of seedlings from *F. Virginiana* it will be seen that there is a continual struggle going on in the *species* (regarding all the so called Fragarias as one species) as to the transformation of the runners into flowering shoots. Sometimes the runner "party" will so get the upper hand that the pistils will be entirely suppressed, in which case the runners push out with so much enthusiasm as to crowd down and frequently destroy their floriferous neighbors. In fact, just in proportion as the plant becomes truly fruit bearing, and with a tendency to produce a succession of fruit on the same stock, is the tendency to produce runners checked. But even this is subject to modification, for they may produce very short peduncles, although bearing full crops of fruit; they will in this case wait till the bearing is pretty well over and then run (Wilson's Albany), or they may produce a few long scapes, and bearing a heavy crop at once and done with it, then push out with great vigor in the running line (see New Jersey Scarlet).

The result of my observation of plants in a state of nature is, that every tribe or genus of plants has its own peculiar law of variation, that all minor variations form around this great central law, and that unless a describer of species is able to recognize this law, the time will come when he will be considered incompetent to perform his undertaking.

In describing Fragarias it will be seen that the law of variation centres in the effort to produce flower spikes out of stolons, therefore, *no character drawn from differing forms of stolons or flower-scapes can possibly serve to identify a species* in this genus.

I have thrown in these general views to excuse Judge Clinton, who, in making a new species out of an accidental variation in the cyme, has done no more than scores have done before him, and many more will in the future, without these considerations. With regard to the merits of this everbearing strawberry as a horticultural novelty I offer no opinion. The Alpine everbearing class of strawberries, however, are too much neglected. They are excellent things in the amateur's garden. There is no reason why they may not be an excellent improvement on others we have had. From the little I have seen of this "Mexican" I think it is. Therefore, though the public will not buy "a new species" they will get their money's worth as a garden fruit.* — T. MEEHAN.

RARE MOSS. — Some rarer mosses have been detected here, of which mention may be made of *Buxbaumia aphylla* and *Tetraplodon australis*. — H. E. P., NORTON, MASS.

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* Since the above was in type I have seen the plants at Detroit, and they confirm what is above written. It is a valuable improvement on all other alpine strawberries introduced to our fruit gardens, but not botanically distinct from the well known alpine form of *F. vesca*. It is, however, interesting from the fact that what I have termed the struggle between the viviparous and the florescent principles, is much more evenly balanced in this than in any other form I have seen. The flower scapes and runners are so blended in character, that at times either partakes largely of the conditions of the other.

ZOÖLOGY.

FOOD PLANTS OF NEW ENGLAND BUTTERFLIES.—The following list of the plants upon which the larvæ of our New England butterflies are known or reasonably supposed to feed, has been drawn up after a careful examination of many authorities, and by the kind communications of several friends. In especial, we would mention Messrs. William Saunders and W. H. Edwards. To give the authorities in every instance would extend the list unnecessarily; any additions to it, or correction and confirmation of the probable food plants, would be most grateful to the author.

Papilio Asterias, cultivated and native umbelliferous plants; often found in abundance on parsley and carrots. *P. Troilus*, sassafras, spicebush, prickly ash; will eat lilac sparingly. *P. Turnus*, apple, wild thorn, choke cherry, cultivated cherry, alder, tulip, black-ash, birch, basswood, oak. *P. Philenor*, aristolochia.

Pieris oleracea, turnip, cabbage, radish, mustard. *P. rapæ*, cabbage. *P. Protodice*, cabbage.

Colias Philodice, clover, garden pea, lupine, lucerne, and other species of medicago.

Terias Lisa, *T. delia*, clover, senna.

Anthocaris Genutia, cruciferous plants.

Chrysophanus Americanus, sorrel and dock. *C. Thoe*, polygonum. *C. Epixanthe*, probably buckbean, water-dock, or some kind of sorrel; possibly cranberry.

Polyommatus Porsenna, probably arrow-wood, elder, or hawthorn.

Lycæna neglecta, cornus and willow; also Erythronium? *L. lucia*, probably the same, and perhaps buckthorn and wild lupine? *L. comyntas*, Lespedeza capitata.

Thecla Clothilde, probably species of Rubus, Genista, and Hedysarum. *T. Falacer*, hawthorn; also oak, and perhaps blackthorn? *T. strigosa*, thorn, oak, apple, willow. *T. humuli*, hop, oak. *T. Auburniana*, smilax?, red cedar? *T. Niphon*, pine. *T. Pembina*, Vicia cracca? *T. Mopsus*, wild cherry, cultivated plum, Eupatorium. *T. Augustus*, Vaccinium? *T. Henrici*, Vaccinium? *T. Acadica*, willow. *T. Scudderii*, Lupinus perennis.

Danais Erippus, different species of Asclepias; also Apocynum.

Limenitis Misippus, willow, poplar, plum. *L. Ursula*, scrub oak, gooseberry, wild cherry, Vaccinium, willow, apple, plum, quince, hawthorn, hornbeam. *L. Arthemis*, thorn. *L. Proserpina*, probably some species of Pyrus.

Argynnis Idalia, *A. Cybele*, *A. Atlantis*, *A. Aphrodite*, probably violets; some of them possibly eat Hedysarum, Polygonum, or Rubus. *A. Myrina*, wild violets and cultivated pansy. *A. Montinus*, probably violets. *A. Bellona*, probably violets; also raspberry?

Melitæa Nycteis, plantain? sunflower. *M. Harrisii*, Diplopappus umbellatus. *M. Tharos*, plantain? *M. Phaeton*, Chelone glabra, hazel; will eat black currant.

Pyrameis cardui, thistle, sunflower, hollyhock, burdock, nettle. *P. Huntera*, Gnaphalium, burdock, thistle, balsam. *P. Atalanta*, nettle, ambrosia, hop.

Junonia Cœnia, Antirrhinum, Linaria.

Vanessa Antiopa, willow, poplar, elm, balm of Gilead. *V. J-album*, hop, elm; also willow? *V. Milbertii*, nettle.

Grapta interrogationis, elm, hop, nettle, ambrosia, basswood, lime. *G. C-argenteum*, wild gooseberry, cultivated currant and blackberry, elm; probably honeysuckle. *G. comma*, hop, ambrosia, nettle. *G. gracilis*, probably nettle, ambrosia, and elm. *G. Faunus*, probably wild gooseberry, elm, and nettle.

Chionobas semidea, probably sedges; possibly lichens.

Satyrus Alope, *S. Nephele*, *S. Portlandia*, grasses and sedges.

Hipparchia Boisduvalii, grasses and sedges; probably also darnel.

Neonympha Eurytris, grasses and sedges.

Heteropterus marginatus, Lespedeza capitata.

Nisoniades Juvenalis, Glycine, Lathyrus. *N. Persius*, *N. Brizo*, Pulse family. *N. Catullus*, Monarda punctata.

Eudamus Tityrus, Robinia pseudacacia and viscosa, American Wistaria. *E. Lycidas*, Hedysarum. *E. Bathyllus*, Glycine and Hedysarum.

Hesperia Metacomet, *H. Verna*, *H. Massasoit*, probably grass. *H. Hobomok*, *H. Pocahontas*, *H. Quadaquina*, grass. *H. Leonardus*, probably grass. *H. Mystic*, *H. Sassacus*, grass. *H. Wingina*, probably grass. *H. Wamsutta*, grass. *H. Acanootus*, *H. Egeremet*, *H. Manataaqua*, probably grass. *H. Ahaton*, grass. *H. Oneko*, *H. Samoset*, *H. Vialis*, probably grass. *H. Metea*, coarse and fine grasses; probably also Panicum. *H. Manoco*, probably grass. *H. Hianna*, Glycine? grasses? *H. Panoquin*, probably grass. *H. Mesapano*, grass? *H. Delaware*, *H. Logan*, Panicum and coarse grasses.

Larvæ of unknown species of Hesperidæ have also been found on poplar, scrub oak, hazel and columbine, and Lespedeza capitata. — SAMUEL H. SCUDDER, *Boston Society of Natural History.*

TENNESSEE WARBLER. — Mr. Boardman's statement in the June number of the NATURALIST relating to the abundance of this warbler in his locality is interesting. It shows how irregular is the distribution of some of our birds. This species seems to be one of a class of birds which, though quite rare in other parts of New England, are not at all so in south-eastern Maine, reaching that region I presume via the St. Lawrence and Maine Central water route. I would here enquire if Mr. Trippe's article on "The Warblers" (NATURALIST, vol. ii.) is not written in the locality of Orange, N. J.?* On page 181 we might infer that he had been giving the Warblers of the New England States, if on a perusal of the preceding pages we had not been convinced to the contrary; the species as found by Mr. Trippe showing a decided tendency to a South Alleghanian fauna, as compared with their distribution in New England. —H. A. PURDIE, *Boston.*

*It is.—EDS.

Papilio (var?) Calverleyi, captured in Florida.—While in Florida last April it was my good fortune to capture a female specimen of *Papilio* var. *Calverleyi* Grote, which in some respects differs from Mr. Grote's type (a male), the description of which appeared in the "Proceedings of the Entomological Society of Philadelphia," vol. ii, and which, till now, was unique. The differences are chiefly as follows: Anterior wings wanting the yellow marginal spots; emarginations very slight; the four yellow patches nearest the internal angle suffused with orange, particularly the basal third. At the extremity of the discal cell is a conspicuous yellow band, bounded apically by the nervures. On the under side this is preceded by a small yellow spot. Apical third of the costal nervure with a fine yellow line. Secondaries with the black ground-color more encroached upon by yellow. Fulvous markings preceding the marginal lunules powdered with whitish scales; above the fulvous, and between it and the discal cell, the color is yellow. Anal ocellus pupilled with a well-defined black spot instead of a "narrow faint blackish arcuated line." Tails black without any sprinkling of yellow. Abdomen with *six rows* of yellow dots. Mr. Grote's specimen had but two rows, and *Papilio Asterias*, of which Mr. Edwards considers it a variety, has four.—Theodore L. Mead, *New York*.

A Remarkable New Jelly-fish.—During an excursion to Eastport, Me., and vicinity, last season, in company with Mr. S. I. Smith and others, we discovered and captured a very large and fine new jelly-fish, rivalling in size even the common red one, *Cyanea arctica*, which it slightly resembles, and for which it might be mistaken at a distance. It is, however, more yellow in color, the large complicated ovaries hanging down below the disk being light orange, and the long frilled mouth appendages bright lemon-yellow. The tentacles are about eighty in number, arranged in a nearly continuous circle, and may extend fifteen or twenty feet in large specimens. They are also very remarkable in being flat and broad, with one edge double and divided into crenulated scallops, which are margined with white, producing a very beautiful appearance. The whole body and tentacles give a white phosphorescent light. The largest specimen was eighteen inches in diameter, and secured among the wharves of Eastport, at noon. It is remarkable that so conspicuous an animal has so long escaped observation. It belongs to a family previously unknown on this coast, and forms the type of a new genus. It was described in the July number of the "American Journal of Science" under the name of *Callinema ornata*.—A. E. Verrill.

The Swedish North Polar Expedition of 1868.—This is the fourth scientific expedition sent out by Sweden to the Arctic regions since 1858, all fruitful in results to geology and other branches of science. After a thorough exploration of Beeren Island on the way, Ice fjord in Spitzbergen, was reached on the thirty-first of July. Ice had already been met with at South Cape, and it increased as they approached the Thousand Isles. The intention was to pass to the eastward of Spitzbergen, but the

ice rendered this impracticable. The geology of Ice fjord was carefully explored during the stay here, and the important discovery made of post-tertiary strata containing fragments of plants and shells now found living much farther south in Norway. It was estimated that 2000 or 3000 head of walrus were annually slaughtered in Spitzbergen by Norwegian walrus-hunters, showing that there must be a large tract of meadow land free from ice to sustain so large a number of these animals, unless they travel over from Nova Zembla. They then endeavored to penetrate to Greenland along the eightieth parallel of latitude, but impenetrable masses of ice, tending north-east and south-west, rendered this impassable. Turning then to north and north-east, they reached 81° 16′ north latitude. Here the ocean was sometimes covered with a thin coating of ice, and the old ice northward was quite impassable, the temperature sinking to 21° F. On the 29th of August the "Sofia" entered Liebde Bay, in Northern Spitzbergen. The deep-sea soundings revealed the interesting fact that Spitzbergen was connected with Scandinavia by a submarine bank, having a *maximum* depth of three hundred fathoms. North and west of Spitzbergen the sea deepens to 2000 fathoms and more. At the greatest depths animal life was found. At 2600 fathoms Foraminifera were brought up. Liebde Bay was now for the first time explored, both in its topography and geology; its climate was mild and calm, while out at sea high winds and snow storms prevailed. After a vain attempt to reach Gilles' Land, the "Sofia," on the 16th of September, made a final endeavor to penetrate the ice to the northward, succeeding at length in reaching 81° 42′, the highest point probably yet reached by a vessel, Scoreby's farthest (in 1806) being 81° 30′; and Parry's (in 1827) 81° 6′; but Parry, in sledges on the ice, reached 82° 45′. The ice to the northward of this was broken, but so closely packed that not even a boat could pass forward, and farther westward (on the meridian of Greenwich) the limit of this impenetrable ice came down to 79°. At night the vessel lay to beside the larger sheets of ice, but the temperature having sunk to 16° F., the risk was run of finding themselves blocked up in the morning. After returning to Spitzbergen, and leaving letters announcing their intentions, they made another last push for the north on the 1st of October, but when in latitude 81° all farther endeavors were put a stop to by a collision with an ice block, which opened a large leak in the vessel's side. With great difficulty they regained the land, the water standing two feet over the cabin floor. The intention of wintering here was then abandoned, and the "Sofia" returned to Norway.—*Scientific Opinion.*

Note on the "Blowing" of Whales.—The celebrated Norwegian naturalist, M. Sars, was the first, or one of the first, to assert that whales when "blowing" did not throw up water into the air, unless the "blow-hole" was beneath the surface. The popular idea has been, and is opposed to this. While cruising in the North Pacific, and Behring's Sea, I paid particular attention to this point. I was very fortunate in seeing

many whales at close quarters, particularly a small species known as the "blackfish," which often played around the vessel all day, sometimes not ten feet from her hull. I observed that while no water, or only a very minute quantity, was ejected when the "blow-hole" was out of water [illegible] the air ejected had an appearance like one's breath on a cold day [illegible] like vapor. Sometimes when very close I fancied I perceived a [illegible] able odor. On mentioning this to the captain, an old whaler, he [illegible] me that the vapor ejected by the sperm whale was so fetid as to nauseate any one immediately who was unused to it; that he had been so affected himself when he first went a whaling, and also that the mucus [illegible] thrown out when "blowing," is commonly believed by whalers [illegible] blister, if it comes in contact with the skin. Cannot some of our New Bedford friends add to our information on these subjects? W. H. [illegible]

While on a voyage to Labrador in 1864, we had good opportunity [illegible] observing the spouting of whales, the stream of vapor issuing [illegible] blow-holes, and immediately disappearing. As we stated in the "Proceedings of the Boston Society of Natural History," for 1864, [illegible] of whales we observed, i. e., the Sperm, Finner and Humpback [illegible] easily distinguished by the differences in the stream of vapor [illegible] when the animal comes to the surface to breathe. Thus according to [illegible] informant, Capt. [illegible] Hamey, an experienced whale fisher [illegible] accurate observer, the "spout" of the sperm whale issues [illegible] stream of vapor from the extreme end of the nose [illegible] of the [illegible] The spout of the Finback forms a single [illegible] about [illegible] feet [illegible] The Right and Humpback [illegible] stream which is directed [illegible]

A. S. P.

[illegible]

care they were entrusted, becoming tired of her charge, turned them out of the cage in which they had thus far been kept. At first they seemed to exult in their new-found freedom, keeping away from the house, and during the greater part of the night answering one another from the trees in the garden, but after a trial of several days, finding themselves unable to procure food, they came back and ventured by degrees into the kitchen, where they were well received and fed, and after that they regularly returned with the twilight, entering through an open window or door, and after flying noiselessly about the room, settling on the edge of a table, or the back of a chair. Early in September they moulted, and in their second plumage still retained their distinguishing colors. They remained with us till the latter part of October, when they both suddenly disappeared.—WILLIAM BREWSTER, *Cambridge, Mass.*

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

THE SALEM MEETING OF THE AMERICAN ASSOCIATION.—It is a sudden transition from the lake and prairie scenery about the great city of Chicago, where the Association held its meetings last year, to the small and quiet City of Peace, resting between the rock-bound coasts of Nahant and Cape Ann, with its picturesque environs and pleasant beaches at Beverly, Swampscot and Nahant. From present appearances the meeting will be largely attended, and the sessions prove at least of the usual interest. As various short excursions about Essex County are projected we give a brief sketch of the physical features of the vicinity of Salem. The soil is underlaid by gneiss rocks, with trap and granite overflows, forming picturesque hills and knolls, of which the highest in the immediate vicinity of Salem is Legg's Hill, about a mile south of the city, from which a good view of the harbors of Salem and Boston, and the Cape Ann shore can be obtained. The trap eruptions prevail through Swampscot, Marblehead and about Salem, rising abruptly into irregular knolls and bosses, with salt marshes or upland clays and gravels stretching away from their base. Along the shore, often very precipitous and broken by caves and fissures, are seen fine exposures of trap dykes and intrusive masses of sienite, indicating in some cases several successive eruptions; the sienites thus injected being often changed into a peculiar greenish or reddish jasper, many pebbles of which are found in the pudding-stone about Roxbury. The age of these rocks is not yet definitely known, and the question of their age and that of the igneous rocks accompanying them, and their relation to the beds of conglomerate about Boston, and the Lower Silurian rocks at Braintree, renders the geology of Essex and Sussex County a most difficult, though extremely interesting study, and one as yet but hardly touched upon by

geologists. Going from Lower Silurian rocks to the clays and gravels of the Quaternary Period, which immediately overlie them, we find these beds resting upon gneiss rocks polished and scratched, often with great distinctness, as upon a hill in North Salem at Dr. W. Mack's summer residence; in Boston Street in Salem; a mile from Salem towards Lynn, on the top of a hill; the scratches all running in a general north-west and south-east direction. Among the many gigantic boulders transported on the backs of the continental glaciers of the early glacial epoch is the famous ship-rock in Danvers. The brickyard clays, which [illegible] the earthy clays composing most of the arable lands of the [illegible] Essex, and in which fossils have only been found at Chelsea and [illegible]ter, are overlaid by thick beds of gravel and sand, which have [illegible] arranged into terraces along the rivers, and on the seaboard [illegible] sea beaches, which can be readily distinguished on the line of the [illegible] Railroad, especially in Chelsea and Somerville. At Andover [illegible] hillocks of sand forming the "moraine terraces" of Professor H[illegible] which border the Merrimac, is the celebrated "horse-back, [illegible] Ridge," that puzzle in Quaternary geology. The student of [illegible] and anthropology can investigate the Indian shell heaps, or Kj[illegible] moddings found along the whole coast, containing pieces of pottery, arrowheads and bones of various animals, especially at Ipsw[illegible], on Plum Island, and many other points, specimens of which are on exhibition in the Museum of the Peabody Academy of Science. [illegible] zoologist will eagerly explore the rocks and [illegible] beaches for the living representatives of animals [illegible] [illegible] in palaeozoic rocks, and the [illegible] the seaweeds thrown up on the beaches, [illegible] brackish waters, and the meeting of Northern and Southern [illegible] the woods and skirting the coast, much of interest.

ANSWERS TO CORRESPONDENTS.

[illegible]

BOOKS RECEIVED.

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SEA-SIDE HOMES: AND WHAT LIVED IN THEM.

BY DR. ELLIOTT COUES, U. S. A.

MILE after mile of sloping sea-beach occupies the front of a low island on the Carolina coast, and contends, along a foamy line, against waves that ceaselessly advance, to be continually repulsed; a sea-front flanked with sand-works blown by the wind into tumuli over the trenches, where lie buried countless shells that will only come to light again as fossils, when the books of to-day, and those who wrote them, have become indistinguishable dust; beyond which there is a vast bed of oozy mire hidden by the rank growth of reeds that rustle and surge with every breath of wind. Among the sand-mounds, defended by these buttresses alike from the open violence of the sea and the insidious approach of the marsh, are sequestered spots, bestrewn with shells, carpeted with slender grasses whose nodding spears trace curious circles in the sand about their roots, with here and there a half-buried vertebra of a stranded whale, or the rib of some ill-fated vessel, telling a tale of disaster by sea,—spots so secluded that the measured cadence of the wave-beats, confused by this and that avenue of approach, only enters with an inarticulate murmur. Here is the chosen home of

two beautiful birds that come and pass the summer months together; a peaceful home, secure, it would seem, from danger of whatever sort; a house that falls not when the rain descends, and the floods come, and the winds blow, though it is built upon the sand. Alas! that even were it founded upon a rock, the gates of ornithology should prevail against it.

It is late in May—the last week of a month that is not, in this warm climate, "a pious fraud of the almanac," as it is in New England—and the birds are busy now. Six weeks ago they came from their winter retreat in the far South, to this well-remembered spot. The Least Terns came dashing along high in the air overhead, their pearly white forms wavering between the blue water and the bluer sky, ruling both and uncertain which to choose; and saw, with cries of exultation, the end of their long journey. As swiftly, yet more secretly, the Wilson's Plovers flitted along the shore, half concealed by colors that repeat the hue of the sand, from one headland to another, across gulf and river's mouth in succession, till they too greet their homes with joyous notes. Separated for a long interval, or at most little heeding each other, the Terns and the Plovers are to come together again, and rear their young under the shadow of each other's wing. While they are flashing through the clear air, or skimming lightly over the mirrored beach, and occupied, after mutual recognition, each in their own way with the preliminaries of the great event of their lives, let us see what manner of birds they are. Then, when we come to look in upon their homes we shall not be visiting strangers.

The Least Tern is, as its name implies, the smallest bird of its kind in our country; but it has several near relatives in other parts of the world: cousins so nearly alike that they have often been mistaken for each other. They form a race, or "subgenus," as the naturalists call it, that is distinguished from other Terns by diminutive size and dainty form, even among a class of birds all of which have ev-

quisitely moulded shapes, and by a crescent of pure white on the forehead, sharply defined in the jetty black of the rest of the crown. They are delicate pearly-blue above, with snowy-white under-plumage, that has an indescribably soft and silky lustre; the long-pointed outer primaries, that cleave the air so deftly, are black, silvered with a hoary gloss of exceeding delicacy; the bill is bright yellow, tipped with black; the feet are of the same color, and are likewise tipped with the black claws. The little bird of our country answering to this description, has a variety of names in and out of the books. In many places it is called "Striker," from the way it has—after hovering in the air, its slender bill pointed straight downward, its clear eyes intently surveying the water below, and at length fixing upon some unlucky shrimp or minnow—of dashing impetuously down to secure its prey beneath the water; and just possibly, its scientific name, *Sterna*, as well as the English derivative, *Stern*, or *Tern*, may be traced to a classic root (seen in *sterno*, "to strew or scatter," and also "to throw down") and have its origin in this same habit. A more apt and elegant designation is that of "Sea-swallow," by which this and other species are universally known. They are all, indeed, swallows of the sea, replacing over the waters those familiar birds of the land, and having many features in common. Popular language has, as usual, caught the idea of these striking points of resemblance, and caged it in an expressive word. Even the written history of this bird's names is not devoid of interest; for a study of the various words unfolds a story of human thought. Thus our forefathers in ornithology called the bird the Least Tern (*Sterna minuta*), because they did not know it was different from the European species of that name; but it is, nevertheless, for the pearl-blue extends over the tail instead of being confined to the back and wings, and the size of the bill, and of the white crescent, are not the same in the two species. Nuttall gives it as the Silvery Tern (*S. argentea*); a pretty name, and one very suitable,

but founded upon the wrong premise, that our species is the same as one that lives in South America. When Dr. Gambel found out that it was different from both these species, he bestowed upon it the title of the Bridled Tern (*S. frenata*), another very distinctive name, that would be well applied, were it not for the fact that M. Lesson, a French ornithologist, had previously called it the Antillean Tern (*S. antillarum*), because it is found in those islands in the winter. So we have no choice in the matter of a scientific name, in which there is not the same license as in the case of our common designations. But let the latter be as various as they may the little bird is always the same. It spends the winter in Central America and about its islands; when spring opens it courses northward to visit us; a few extend along the Pacific Coast, some up the Mississippi and its tribuaries, almost to their very sources; and more along the shores of the Atlantic. Some of the latter go as far as New England, but there are attractions all along, and detachments drop off by the way, stopping here and there, till the ranks are fairly decimated before the most adventurous birds make their final halt. But "their tricks and their manners" are pretty much the same under all circumstances, and what these are we shall presently see.

A very different bird is Wilson's Plover; a wader, not a swimmer; as they say, in words as long as the bird's legs, a grallatorial, not a natatorial, species; which simply means that the little bird is content to run along the sand and dabble with bill and feet, in the wavelets, instead of boldly dashing in among the breakers, like a Tern, for instance. It belongs to a genus well-named *Ægialitis*, which signifies a "dweller by the sea," and has never been known to forfeit its right to the name. We have several other species of the same group. The commonest and most widely diffused of these is the "Killdeer," that everybody knows throughout the length and breadth of the land; the Ring Plover and Piping Plover are two others, familiar to all New England-

ers. Wilson's is characteristic of the South Atlantic coast; it only incidentally, as it were, strays northward as far as Massachusetts, and is, consequently, the least generally known of the four kinds; but once seen it can never be mistaken afterward. It is smaller than the Killdeer, but larger than either the Ring-necked or the Piping Plover, to which it is very similar in coloration, if not in the precise tint. The under parts of all three are white; the upper parts of Wilson's are much darker than those of the Piping, and yet a trifle lighter than those of the Ring Plover. A collar of pure black crosses the white of the breast; a crescent of black occupies the crown between the eyes, separated from the bill by the white forehead; on the nape and sides of the head the grayish brown merges into a clear warm buff. This, it must be remembered, is only the nuptial plumage, and of the male bird; the latter, at other seasons, and the female at all times, have these black bands replaced by buffy brown; and this is the plumage in which the bird is oftenest described. But the greatest peculiarity remains to be noticed. Wilson's Plover has a very large entirely black bill, while both the Ring and the Piping have a very small bill, orange yellow at the base, tipped with black. For the rest it wants the bright-colored circle around the eyes, formed by the margin of the lids, that the other species display during the breeding season. Its eyes are clear brown; its legs livid flesh colored, and longer than those of the others; it is not half-webbed like the Ring Plover—only about as much so as the Piping. Its large black bill gives it a singular expression, and undoubtedly corresponds to some difference in the nature of its food, if we could only find out exactly what. Such is the bird that hurries along the coast from the South in April. Upon their arrival they gather in small flocks, of from half a dozen to a score or more, and ramble over both the clean sea-beach and the muddy flats in search of food, sometimes straying into the adjoining salt-meadows if the grass be short and scanty enough not to

impede their way. They are naturally gentle and confiding birds, thinking no evil, and prone to take others to be as peaceable and harmless as themselves; but they have only too often to learn wisdom by saddest experience of broken limbs and maimed bodies, and to oppose treachery by wariness and caution. In the spring, if not at other times, they have a note that is half a whistle, half a chirrup, and sounds very different from the clear mellow piping of either of their nearest relatives. After a little while spent in recuperating their energies after their long flight, in putting on their perfect dress, in sham fights and ardent pursuits along the strand, more pressing duties call them from the water's edge to the recesses of the sand-hills. There we shall find them "at home," no longer in flocks but in pairs, and keeping house with the Sea-swallows.

The spot is indicated by the fleecy cloud of the Terns flecking the air overhead. We toil on over beds of loose dry sand, in which our feet sink and slip backward, and gain the recess among the mounds. The ground is here more firm and even; the wind has swept it clean of superfluous sand, and piled up the sweepings here and there in odd nooks; the rains have packed it tight and washed every shell and pebble clean. The most careful housekeeper in the world could make her home no more tidy than the wind and rain have made this shelly dwelling-place of the Terns and Plovers. As we walk on, we see that other visitors have been before us, each one leaving its "card" engraven on the fine sand. Here goes a curious track straight up and over a sand hillock, as if half a dozen little animals had ran a race one after the other, on stilts, the points of which pecked into the sand and formed a band of indentations four or five inches broad. These are the footprints of only one creature, however,— the sand-crab, a curious little fellow, with a square body, and eyes upon the ends of two poles that stick straight out when wanted for use, and shut into the shell like the blades of a pocket-knife, when their owner goes to

sleep, — a singular crab indeed, mounted upon a wonderfully long set of eight legs (to say nothing of two claw-nippers), all of which he contrives to move at just the right moment, as if he were playing a tune upon piano keys, and so plays himself sidewise over the sand with marvellous ease and celerity, the only wonder is that he does not forget a leg in his haste. He is a very grallatorial crab, and lives in the holes in the sand we see all about, just like a prairie-dog. There is a tortuous trail along the sand, where a water-snake, perhaps a *Nerodia sipedon*, crawled out of his pool in the marsh beyond, to enjoy the sun's rays, or possibly on an egging expedition like ourselves. Here is a fainter line, straight as an arrow, looking just as if a pencil had been drawn along a ruler's edge; it is the mark left by the long slender tail of the little striped lizard, and if we look closely we shall see it bounded on either side by a succession of faint dots where the creature's toes barely disturbed the grains of sand. There again is a curious track, a pair of rounded depressions, side by side, and hardly more than an inch apart, outside of which, in the intermediate distances, are another pair, wider apart, and much longer. It is clear that a Marsh Rabbit has passed this way, planting his fore-feet straight downward, and drawing his hinder ones leisurely after, half squatting at each step, as he loped out of his home in the bushes to nip the beach grass for a change of diet. And so we might go on reading signs as plain as print; but the birds are by this time alarmed as they never were by former visitors. They know by intuition that we are not one of them, though among them, and that our coming bodes no good, however much we may affect to care for them in an abstract way. So in a moment all is changed, and confusion reigns where were peace and quiet. The quick-witted Terns were the first to sound the alarm; they had watched our approach, and straightway changed their heedless and joyous cries to notes of anger and fear; at the signal the sitting birds had arisen from their eggs and

joined those already overhead. The male Plovers, off foraging for insects and minute sea-creatures, surprised at the noise, had come hurrying home, only to have their worst fears confirmed, and be met half-way by their terrified mates, who had stolen quietly from their nests when the Terns deserted theirs, instinctively looking for comfort and protection where it had never been denied before. It is a strange sight, and a mournful one, already too painful to be wholly interesting, and the tragical end has not come yet. The Terns seem not to know what fear is; they dash about our heads, plunge as though to strike us, recede a little, approach again, always keeping in a cloud above us; and from every throat come notes of anger and fear and beseeching combined; a very Babel of tongues. The Plovers are more timorous; they are flitting to and fro, low over the sand, at a little distance, in anxious groups of three or four, with indescribably touching appeals for mercy to spare their homes; now alighting and squatting in hopes they are still undiscovered, and again running swiftly along, too frightened for a moment's rest. A dark day indeed for the poor birds! Bird's-nesting is a sad business, at best; it makes little difference to the birds, it is to be feared, whether their eggs are stolen by school-boys, to be played with and forgotten before the Saturday afternoon is over, or by grown up people to make books with, and be kept thereafter in cabinet drawers. What difference there is, seems to be that the boys let the old birds off altogether, and are satisfied with robbing the nests; while the larger children rob and then shoot the parent birds, to "authenticate the specimens."

Where are the eggs? Here, there, and everywhere about the sand lie the Tern's, till we are in danger of treading on them unawares. There are not so many of the Plover's, though still plenty for our purpose; but both kinds are nearly of the same color as the sand, and their markings conform to the unvarying variegation of color of the shelly strand, so that it is an easy matter not to see them, even

when looking straight at them. Here is a set of Plovers' eggs, and there, not a yard off, one of Terns'; we may sit down and examine both together. It may be best, however, after noticing carefully the nests and their surroundings, to gather a lot of each kind of egg, and carry them home with us for more particular examination.

Properly speaking there are really no "nests" in either case. Neither the Tern nor the Plover has any architectural instinct, because none is needed. Both lay their eggs in a slight hollow in the sand, about four inches in diameter; but even this hollowing is sometimes scarcely appreciable, and the eggs seem as if dropped by accident on the ground. It is probable that at first no hollow, or only the slightest one, is made; and that subsequently the depression becomes better defined by the movements to which the eggs may be subjected, and the weight and motions of the parent birds or young. In some instances there is a difference between the two kinds of nesting-spots, happening thus: the Plovers sometimes lay in a scanty tuft of slender straggling grass, which was not done by any of the Terns, at this breeding-place; and again, the Terns frequently line the depression with little flat bits of shell, which the Plovers have not been observed to do. Sometimes the pieces of shell seem to have been lying there before, and thus only to have been used as a nest-lining by accident as it were; in other cases the regular disposition of the fragments in a circle, leaves no doubt that they were carefully arranged by the birds. This method of making a shell-nest is just like that of the Auks and Guillemots, that breed in cracks in the rocks, and raise a little platform of pebbles to keep their eggs from the wet; and is, doubtless, for the same purpose,—to defend the eggs from whatever moisture might be in the sand. Still, of two Terns' nests, side by side, one may have the shells, and the other be without them, or at least not have them specially arranged. Neither bird uses any dried grasses,

sea-weed, or other soft pliable substances, in this particular locality at least.

The number of eggs deposited must next claim our attention; and in this matter, as seeing is believing, we must differ with some very respectable authorities. It is a common belief, circulated from one writer's book to another's, that Terns generally lay three eggs, and the little Sandpipers and Plovers always four. The belief is true enough, as a general rule; but every rule has its exceptions, and here are two notable ones. The Least Tern, breeding in North Carolina, generally lays *two* eggs; sometimes only *one;* rarely (if ever) three; and never four; at any rate, we have not found more than two in any instance, and our experience may count for something, seeing that we have just explored a tolerably extensive breeding place. Still it would be injudicious for us to proclaim that the bird may not lay three in other localities. But as for four eggs from one Least Tern at a single laying we flatly refuse to believe it till we see it. If any one is inclined to object to the assertion that the *one* egg, found in some instances, would have been succeeded by another, we can discountenance the assumption by replying that the solitary eggs in question were nearly hatched when found. Again, Wilson's Plover lays three eggs,—no more, no less, as far as our observations have gone, with respect to nests actually found. The suggestion that the fourth one would have been laid in due time is combatted by what has just been advanced in the other case, namely, the mature condition of the embryos. Yet we know the bird sometimes lays four, because we have killed females just going to lay, finding one egg in the oviduct, almost ready to be expelled, and the three others in a highly developed state, still attached to the ovary. The time of laying varies a great deal, in the cases of both the birds. They may deposit eggs at any time between the second week in May and the first in June; the greatest number lay about May 20th. Some of the Terns may even commence

earlier, as young birds, already quite strong of wing, are to be seen flying about by the 20th of June. Early in the latter month, nearly fresh eggs, eggs nearly hatched, and newly fledged young, of the Plover, may all be observed. These little nestlings are very pretty and very curious specimens of early birdhood; they can run quite cleverly over the sand as soon as fairly dry from the egg, if not "with half a shell on their backs," as is popularly supposed to be the case with young partridges; and are rather difficult to find, from their knack of hiding, like their parents, by squatting closely on the sand. Their legs seem disproportionately long, like a young colt's. They have black bills, like their parents, from the moment of birth. They are covered all over, except a little space on the neck, with woolly down, that is white below, and beautifully variegated with black and buffy brown on the upper parts. The newly fledged Terns are very different from the old ones, being curiously mottled above with different colors, in which the pearl-blue scarcely shows; without a black cap, the head being white, except some slaty feathers over the ears and nape; the bill blackish, and the feet dull-colored, and the tail much less forked. They cannot be mistaken for any other species, however, for there are none so small as they.

We have now only to examine the eggs we have collected; and here again we must give the specimens themselves precedence over authorities. If Nuttall, for example, had had ours before him when he wrote of the Least Tern, we should not now read in his Manual, that "the eggs, three or four in number . . . . are about one and a half inches, by three-quarters of an inch in breadth." Ours, we see, are considerably smaller than this, and of a different shape from that implied by these dimensions, averaging only 1.25 inches long, by just 1.00 in breadth. The longest and most pointed one is 1.30 by 1.00, the shortest and roundest 1.20 by .98; these measurements probably representing very nearly the extremes of variation. The ground color

varies decidedly; the differences may be reduced to two kinds, in one of which the color is very pale clear greenish-white, and in the other pale-dull drab or olive whitish, the latter apparently due to the mixture of a little brownish in the green. These colors are speckled all over with small splashes, irregular spots, and dots, of clear brown of several shades; and others of a paler, illy-defined, somewhat lilac, hue, appearing as if it were brown *in* the shell, instead of on the surface. The markings are often very evenly distributed over the whole egg, but more frequently, perhaps, tend to form a circle, at or around the larger end, particularly in those cases where they are large and splashed. The point of the egg is often free from markings, or with only a few small dots.

The Plover's eggs are of the same general pattern of coloration as the Terns', but are larger, and otherwise conspicuously different. The variation, both in size and shape, is very considerable; thus one measures 1.45 by 1.05, and another only 1.22 by 1.00; a variation not only of absolute size but also of relative length of the long and short axes, resulting in a very decided difference of shape. All agree in having the greatest short diameter near the large end, as usual among birds of the order, and the difference is mainly due to a greater or less elongation and pointedness of the smaller end. The shorter axis varies only within narrow limits; but even in eggs taken from the same nest a difference of .15 may be observed in the lengths of the long axes, with, of course, a corresponding discrepancy in contour. The ground color is difficult to name; it may be called pale olive-drab, more decidedly inclining to a greenish hue in some, and to a brownish in others. The eggs are thickly marked all over with brown so dark as to be almost black; the markings are in irregular, sharply defined spots, small splashes, and fine dots. In some specimens the markings show a tendency to run into fine lines, and in these are smallest, darkest, most numerous and most sharply outlined;

but ordinarily the distinctive splashed character is maintained. Commonly the markings are rather larger, and, consequently more thickly set on the larger part of the egg, where there is also some tendency to run together, though scarcely to form a ring around the butt; but in none of the specimens examined was the pointed end free from spots. Here and there may usually be observed a few pale obsolete spots, as noticed in the Terns' eggs, but they are fewer and much less conspicuous, and in fact are hardly to be detected without close scrutiny.

RAMBLES IN FLORIDA.

BY R. E. C. STEARNS.

PART II.

The trip across Florida, from the Atlantic Ocean to the Gulf of Mexico, is made by railroad. Rising with the birds and eating an early breakfast, a ten minutes walk takes us to the depot, which is about a mile from the hotels. There is no commotion or hustling, no noise of many hackmen nor crowding of passengers, neither any difficulty in finding a seat; a single car is sufficient to accommodate the few persons that have occasion to travel. Of the small number, probably one-half will stop at stations by the way; the principal business of the road is the transportation of freight, and were it not for the extensive business in the forwarding of merchandize, consisting of cotton, rosin, sugar, lumber, etc., on account of the steamship connections which form, together with this road, a through line from New Orleans to New York, by which much time is saved compared with the other routes, it would, doubtless, prove unprofitable to its proprietors.

The ride from the Ocean to the Gulf absorbs nearly a day, for it will be supper time when we reach Way Key. The

landscape is exceedingly monotonous, and the journey somewhat tiresome; nevertheless, it affords an opportunity for observation, and a very fair idea of the general character of the country can be obtained. There are no pretty villages with neat houses and bright garden patches to please the eye; a few shabby towns are passed through, or stopped at for a moment to discharge freight or to allow a brace of passengers to get off or on. Away from the sad looking villages, an isolated cabin or a cluster of huts occupied by tar and rosin makers are passed by. The forest scenery has neither tropical beauty nor the grandeur of the pineries of Maine, Michigan or California,* which so impresses the beholder; the prevailing timber is the *Pinus palustris*, or pitch-pine; the trees are not above medium size and stand many paces apart: hundreds may be seen whose sides are defaced by the rough scars or notches made by the ruthless axes of the pitch gatherers, and some trees have many of these wounds. At one place there is an extensive establishment for the distillation of the spirits of turpentine, which employs several persons; at other points saw-mills may be seen. The products of the pines are the prime fountain of revenue to the inhabitants of the neighborhood for many miles along the line of the railway.

Here, as elsewhere within the territory of the United States, the pine tree and not the palm, contributes wholly, or in part, to the maintenance of large communities, and although the palms, by their fruits, furnish the chief subsistence for a large portion of the inhabitants of the tropics, and entire tribes of men in the valley of the Orinoco live for several months in the year on their fruits, yet it is undoubtedly true that a much greater proportion of the population of the globe are indirectly supplied with the [illegible]

* [illegible] the Redwoods [illegible] Pines, some of which measure over [illegible] feet

food through the generous bounty of the pines than by any other of the forest tribes; yet, perhaps, the voluptuous beauty of the palms has inspired the poetic muse more frequently than the sedate bearing and sturdy merits of the noble pines; the *Artocarpus incisa* is no more the "tree of bread" to the naked natives of the South Sea Islands, than is the pine tree to a greater number of civilized and refined people. But each is glorious in its way!

The sallow and sickly faces of many of the people hint strongly of fever and ague. The small size of the cattle shows that the country is overstocked, or that the pasturage is limited and poor; the milk used in the so called hotels is the condensed milk from the North; the butter is imported, and the beef is stringy and dry; most of the corn used, at least in this part of the state, is brought from abroad, and the country does not produce the wheat that the people consume. Few fruit trees are seen from the car windows; an occasional orange or peach tree is therefore noticed. We are informed that this is not a fruit region, but that in the vicinity of the St. John's River, and in that part of the state, the orchards are large and numerous.

The stranger is impressed by the general flatness of the country; nothing like an embankment or an excavation upon the line of the road can be seen. The surface is never more than very slightly undulating, and is covered with sand, except in such places as are wet or swampy. After a rain every depression becomes a pool or lake, to be in time absorbed by the sand or evaporated by the sun; as the elevation of the land is but little above the sea, the process of draining the surface by the sinking of the water must be exceedingly slow. The topography may be better understood, perhaps, when we consider that South Florida is but a succession of beaches piled up by the sea, a superstructure of shore debris resting upon ancient coral reefs.* This

*Though previously aware of the structure of Southern Florida, we were surprised to discover the ancient reef formation extending so much farther to the north than we

is confirmed by the outcroppings of the old reefs, that, projecting from the ground, are visible at various points by the side of the road. In addition to the accumulation of sands portions of the state have undoubtedly been, and perhaps are still being gradually elevated.

Agassiz estimates that not "less than seventy thousand years have elapsed since the coral reefs already known to exist in Florida began to grow."* What the area of the state may be seven hundred centuries hence we can only conjecture. The same agencies are still in active operation. It will, probably, extend much farther in a southerly direction, and the southern part of the state will be greatly widened toward the west. Those insignificant (so far as size is considered) but persistent workers, the reef-building masons, the *Astræans*, the *Meandrinas* and the *Porites*, are cooperative workers at the present time as during the centuries that have passed.† Deep in the sea the foundations of future reefs are being laid, upon which the more ornamental coral-workers, the *Madrepores*, will attach their snow-white shrubbery, fringing the surfaces and edges with beautiful forms, an elaborate and graceful finish to otherwise substantial structures.‡

The few tree Palmettos or Cabbage-palms (*Chamærops palmetto*) that we have already met, indicate that we are approaching the Gulf; as we move along the number increases, and numerous fine specimens are seen.

had been led to infer from anything we had read on the subject. We [illegible] evidence that the reef builders at the present time, upon either coast of Florida, are working upon so high a northern line; this may be owing to a decreased temperature, an increased freshness, the greater impurity of the water, or to a combination of these causes.

* Methods of Study in Natural History, p. [illegible]

† Ehrenberg alleges that certain enormous corals which he saw in the Red Sea, and parts of which are still tenanted by working polyps, were alive in the time of the Pharaohs, and have been growing and enlarging ever since." [illegible]

‡ "The red coral of commerce (*Corallium rubrum*), so much admired for its [illegible] color and the high polish of which it is susceptible, adapting it for making [illegible] and other trinkets, etc., forms a very profitable trade in the Mediterranean, where it is chiefly found. It is procured by dredging and diving and its fishing gives employment to numbers of people." (Baird's Dictionary of Natural History, p. 35.)

Here the road runs through wet and swampy ground, with lagoons and stagnant water upon the right and left. The sun bade us "good night" nearly an hour ago, and objects not distant are indistinct in the dusk of the twilight. Presently the train moves more slowly, and looking out we see the twinkling of lights; like a boy travelling in a lonesome place the locomotive whistles, but with the vim of a thousand fifers, and then comes to a halt. Out we get into the darkness and look around; sand is under our feet, and a scanty show of vegetation, principally coarse wiry marsh grass, is about us, and the air is chilly. With a benediction upon the inventor of overcoats, we wrap ourselves closely, and realize that a fireside would be more comfortable than the open air; so with a negro for a guide we start for a public house, to await the dawning of another day before farther spying out the pride or nakedness of the land.

Way Key is one of a group of islands known as Cedar Keys; it is of small size, irregular outline, and for the most part sandy and low, though in some places marshy and wet. Here, as at Fernandina, the railroad company have made extensive improvements, by the erection of a large freight-house, and a substantial wharf for the accommodation of steamers that touch here en route to and from New Orleans, Key West and Havana.

The town consists of a few buildings, not remarkable either for architecture or workmanship, and the hotels are a practical joke upon the traveller. From the end of the railroad wharf, the disciple of Izaak Walton can enjoy his favorite pastime by catching trout, which are plenty, and fine fat oysters abound in the neighborhood. Were it not for the fishes and oysters the fare at the taverns would be wretchedly mean.

The scenery, as viewed from the long wharf, is attractive; other islands of the group being quite near. The "old town," as it is called, is much better located, in point of elevation, than the recent one. It is built upon an island

directly opposite from the principal wharf, and presents a pleasant appearance; beyond is the lighthouse, situated upon an eminence on Sea-horse Key. Sea-horses are, probably, the only horses in or about Cedar Keys, for at Way Key the sole beast of burden, at the time of our visit, was a poor cow,* which, harnessed into a dray, was forced to do the hauling for the place. What a commentary upon the progressiveness and business enterprise of a community! Our regard for the sex made us indignant at beholding the degradation of the patient brute.

At the south end of Way Key there is a group of mounds of unusual size and elevation; the largest and most southerly presents an abrupt face to the beach, having been partially dug away. Its height, as seen from this point, cannot be far from twenty-five feet: it was, probably, before being disturbed, not less than thirty feet; but this, as well as others of the group was, like the larger mound near Fernandina, used for military purposes during the recent war. The aggregate thickness of the shell strata with the intercalated seams of ashes, upon the southerly side of the principal mound, and directly facing the sea, is about twenty feet, and composed principally of the valves of Oysters (*Ostrea Virginica*), while on the north side of the same mound the shell deposit is somewhat less in thickness, and largely composed of the valves of Scallops (*Pecten dislocatus*). But it must not be understood that the above are the only species of shells found here, for numerous specimens of the mammoth Fasciolaria (*F. gigantea*), and others of the same family are represented. Large shells of *Busycon* [illegible], and fragments of Quahaug valves (*Mercenaria M*[illegible]) [illegible], are quite abundant. Without a farther enumeration of the species contained in this, the largest of the Way Key mounds, we will hastily glance at others near by. J[illegible]

* [illegible]

north of the above is the second in point of size, but the shell deposit, composed of the same species, is not as thick or deep, while at the north-east is a third mound of exceedingly regular form, also composed of shells; this latter has not been materially defaced, though a house of considerable size has been erected upon its summit. Between the two largest mounds, and connecting them, is a piece of flat or slightly uneven ground, which was used apparently for burial purposes, for here can be obtained human remains undoubtedly aboriginal, and fragments of pottery of large size may be picked up. At other places in the vicinity human bones may be found, but there is no certainty that they are aboriginal. During the war this island was the asylum for deserters and refugees, and the yellow fever and cholera carried off great numbers. They were buried carelessly, and the unmarked graves are scattered over the higher land of the Key.

In examining this part of the island, which is covered with various forms of shrubbery, the visitor frequently stumbles over the hidden resting-place of some poor victim of pestilential disease. A few trees may be seen here and there growing out of the sides or summits of the mounds; the latter are so crossed and defaced by the embankments, ditches and rifle-pits, that it is difficult or impossible to define their original forms and proportions. Before leaving this extensive and interesting cluster of mounds, we ascended to the highest point to obtain a view of the surrounding scenery. Immediately below, and but a few yards from the base of the elevation, a sloping shelly beach runs gradually down beneath the placid waters of the Gulf; the white sail of a boat, hardly moving in the bland and gentle breeze, and the whiter wings of the circling gulls, with islands near and distant, a cloudless sky, and a bright sunshine, combined to form a scene of quiet and dreamy beauty. Not far from the mounds is a mill, where the soft cedar is sawed into blocks of convenient size for the use of the

manufacturers of lead pencils, and in the neighborhood are rude shanties, cabins and houses, that, viewed with the trees and mounds and water, furnish pretty sketches for the drawing-book.

Not many species of shells can be found upon the beach, though much of interest may be dredged in the deeper water of the channel a few hundred yards from the shore. Upon an old wreck, reached at low tide by means of a boat, a species of Murex (*M. rufus*) may be collected, and the very common Littorina (*L. irrorata*) may be gathered in quantities, sticking to the marsh grass just above the mud.

The steamer from New Orleans that is to carry us farther South having unexpectedly arrived, we were prevented from making an examination of the adjoining islands, or as thorough an investigation of the mounds as their importance demanded. Early in the afternoon we were "all aboard," and soon after the hawsers were cast loose and the steamer was under way; slowly feeling the course through a crooked and insufficient channel an hour passed away before we were in water deep enough to admit of greater speed. The water is so shallow that vessels are compelled to keep a long distance from shore, and the land being flat, but little can be seen from the deck. The mildness of the temperature, the clear sky and smooth sea, made it a delightful trip; and we shall ever remember with pleasure the down voyage from Cedar Keys to Tampa Bay.

THE SAGE BRUSH.

BY W. W. BAILEY.

In every account of Western travel we meet with this name. It is as common in the vernacular of Nevada and Utah as the word grass is with us, and for the like reason that the plant to which the title is applied is everywhere

present. Readers at the East generally have an entirely incorrect idea of the shrub. If they think of it at all they are misled by its popular name, and consider it synonymous with, or nearly related to the common sage (*Salvia*) of the gardens. The title, however, is not bestowed upon it on account of any actual relationship to that genus of the mint family (*Labiatæ*), but merely from its similarity of odor. This is evolved in consequence of any friction, such as results from rubbing the leaves between the hands, or riding among the bushes. Indeed the plant emits its characteristic aroma even when undisturbed, but not in so exaggerated a degree. It is the scent of "wormwood," which is the true English title of the so called wild sage. Its botanical name is *Artemisia*, bestowed in honor of Artemis or Diana. There are many species found upon the Great Plains and in the Interior Basin (*filifolia*, *cana*, *tridentata*, *etc.*). The species *tridentata* is what I purpose to describe. The specific name means simply "three-toothed," and has reference to the dentated apex of the wedge-shaped leaves.

The plant belongs not to the mints, suggestive of cooling beverages and savory sauces, but to the composites, or great order in which we find the dandelion, the asters, and the sunflowers. The inconspicuous blossoms are densely panicled. The leaves are not green, but silvery or ashy in color. They are borne on scraggy stems, rising, generally, from large and wide-spreading roots. These roots are spirally twisted, and unravel, as it were, like the strands of a rope. They are much used for firewood in this barren section, where little other fuel presents itself. They make a warm fire, but burn much too rapidly. As the supply, however, is inexhaustible, this fault is of no great consequence. They are even used at times in mills and smelting works, where it is impossible to obtain wood.

After careful inquiry I am led to the conclusion that no one has ever seen a *young* sage brush. Even the most confident settler becomes involved in his account when persist-

ently questioned, and cannot tell when or where he noticed the phenomenon. All the specimens met with, and their name is legion, look as if they had been produced, not only mature, but aged: as if they were coeval with the mountains and plains upon which they are found. To the deficiency of chlorophyl in the plant is to be attributed its generally wretched appearance, which is increased by the tendency which the brittle twigs evince to break into snags and prickles.

Where the plant grows to a height of from six to ten feet, as it occasionally does, it is indicative of good soil, and generally of water or moisture present at certain seasons. If it is then uprooted, and vegetables planted in its place, they thrive most abundantly. All that is wanting to much of the apparently sterile soil is the necessary rain to refresh it. Perseverence in systematic irrigation has, in some places, recovered the desert and caused it to "blossom like the rose." The artemisia scorns the alkali flats, and in such localities is succeeded by the wretched grease-wood (*O[illegible]*), and various chenopodiums and other salt-loving plants. Some of these are most uninviting and indescribable in appearance. To the traveller they are the synonym of abomination.

The sage-brush grows in clumps, usually separated a few feet from each other. Often it surmounts a mound of from five or six feet in height. These elevations, rising above the general surface of the plain, dot it in every direction, and one may ride among them for days together. It would appear that the plants mark the original level of the plain, and that the earth around has been eroded where it was not bound by their interlacing roots. Whether the wind or rain, for it does rain here at times, has been the more potent agent in producing this effect, I am not prepared to affirm. In any other country one would unhesitatingly decide in favor of the latter. Here, however, the wind is almost equally powerful in transforming the face of nature.

In early spring many herbs, and even delicate flowers, may be found among the sage brushes. Some of these plants are exceedingly curious in appearance. Among them are numerous species of the difficult genus *Erioganum; Astragalus* and *Dalea* are also frequent, with *Bigelovia, Linosyris,* and other species of compositæ. Beneath the artemisia burrow innumerable frisky lizards, chipmunks, and rabbits (*Lepus callotis*). The latter have the uncomplimentary adjective, "jackass" prefixed to their name, which is a pointed reference to the length of their ears. Then there is the cowardly coyoté, always semi-translucent with hunger. Besides these four-footed creatures, the sage hen is frequently seen, one of the dainties of the traveller's table. One never recovers from his surprise that there should be so much life where apparently there is so little to support it. It is said that the animals live upon each other; but there must be unity to start from, and what that unity finds to sustain it is most questionable.

The artemisia covers the greater part of the Interior Basin between the Sierra Nevada and the Rocky Mountains. It is found from Idaho and Montana to the confines of Mexico. It grows, not only upon the plains and lowlands, but upon the mountains to an altitude of seven or eight thousand feet. In travelling one is rarely out of sight of it. Above is the clear sky; below, and on all sides, the omnipresent sage.

The uses of the plant it must be confessed are limited. Its first and most obvious purpose is to serve as a substitute for fuel. The word substitute is used advisedly. It cannot be dignified by the name of fuel, but does very well in the absence of anything better, and is pined for when, as often happens, there is nothing as good. Rough fences are sometimes made of the uprooted shrubs, or miry places in the highway filled up with them and then covered with earth. Stock will feed upon it when nothing else is obtainable, as doubtless will the Indians, who are not at all particular as

to diet. Whatever may be its actual purpose in nature's economy, it has a good effect whether intended or not, viz., to cause an appreciation of the "greenwood tree." After living amidst the sage for a year, an elm or an oak becomes a wonder, the giant Sequoia of California a miracle. Arborescence, which custom has made familiar to us from childhood, becomes suddenly a mystery, and ever afterwards we cherish all trees with especial fondness, and are thankful to the kind fortune which allots us a home with other surroundings than the forlorn artemisia.

THE DRIVERS.

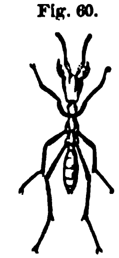
BY DR. G. A. PERKINS.

A VERY few hours' residence in the tropical regions of Africa brings one into a very undesirable familiarity with that extensive tribe of insects, the ants, some species of which are found in all parts of the world, but which are greatly multiplied in the tropical regions of the globe. Africa, it is believed, can boast of a greater variety than any other land. Their name here is legion. They are everywhere; out of doors and in doors; in your food and in your bed, determined to share both. They are of all sizes, some so small that they pass easily between the threads of common muslin, and even insinuate themselves into your watch as it hangs in your chamber; others measure nearly an inch in length. The habits and food of the different species differ greatly. Some, as the Termites, called White ants (which however are not true ants, but Neuropterous insects), eat vegetable matter exclusively, destroying our houses, furniture and clothing; others are carnivorous; others feed upon sugar or the sweet juices of plants. Any one of the many species, found in so great abundance,

would furnish sufficient material for months of study for the enthusiastic naturalist.

It is of one species only that I propose to speak, the Drivers (*Anomma arcens* of Westwood? Fig. 60); an insect whose life history is yet very imperfectly known, but of whose habits the dweller in the tropical regions of West Africa cannot long remain ignorant.

Fig. 60.



The Driver ants vary in size from three-quarters of an inch to one-third of an inch in length, the soldiers being the largest. They are of a glossy jet-black color, with a large head armed with exceedingly sharp, branching forceps, or mandibles, with which they seize and cut up their prey. They do not appear to have any fixed habitations, as do the Termites, but excavate the earth from between the roots of trees, and in the cavity thus formed lay their eggs and rear their young, and from which they issue in incredible numbers (literally millions of millions) to go upon their raids.

The night is chosen for their foraging expeditions. In the midst of social enjoyment the stirring announcement is made, "Here are the drivers!" and, instantly as by an electric shock, all are on the alert to escape a personal attack. Lanterns and bamboo torches are lighted, and a search made about the house to learn the direction taken by the assailants; and if in their usual numbers the house is often left to them entirely for hours. And still more unwelcome at the hour of midnight is the bleating of sheep, and cackling of hens, in the enclosure. "All hands" are awaked from their slumbers, and the whole yard lighted; the animals are released from confinement and left to take care of themselves; the fowls removed to a place of safety, if one is to be found; but if neglected and left without the chance of escape their destruction is sure.

The Drivers are alike the enemy of man and beast, though there are times when their visits are most welcome. On their approach every kind of vermin is seized with con-

sternation, and seek safety in flight. Centipedes, Cockroaches, scorpions, etc., etc., leave their hiding-places, and are seen seeking places of greater security, only to fall at last into the clutches of their relentless foe, from whom there is no escape.

An invading army could not exhibit a higher state of discipline than is seen in the movements of these insects. They enter a house usually at one point, where a strong guard is stationed to defend the pass; they then branch off right and left, and again divide, and subdivide, till the whole ground is completely covered; not an inch is left unexplored, and every crack and cranny is entered, giving but little hope of escape to any creature that may be found secreted there. Attacking their prey they plunge their forceps into it, regardless of the size or strength of their antagonist. Nothing will cause them to relax their hold. The animal or insect writhes and twists under the pain, but his case is rendered more hopeless every moment by additions to the number of his assailants; at length, when completely exhausted by struggling, he yields to his fate, and is dispatched at the victors' leisure.

The attack goes on simultaneously, in different parts of the house. Animal substance being almost exclusively the food of the Drivers, an immense number of the smaller vermin that infest our dwellings are consumed by them, and some of the larger animals when confined are also destroyed by them. They have been known to attack a human being when rendered helpless by disease, and cause his death in a few hours. It is interesting to see a band of these marauders returning home from the scene of plunder on the approach of day. Issuing from the same place they entered, they are each seen bearing away some trophy with them: a joint of a cockroach's leg, the body of a spider, or the larva of some insects, etc., are the various spoils. As the laborers pass on with their loads they are guarded by a large body of soldiers which are stationed along the sides of their

path; or, if they are to pass through a place of uncommon exposure, these soldiers form a covered passage, by standing upon each other's back and hooking their forceps together, through this arch thus formed the laborers pass in safety.

When they leave a house it must be from some signal from the leaders, as some of them are seen running from one to another evidently giving command. The retreat is made in good order; not one individual is ever left behind. They often bridge narrow streams of water when these come across their path, by going in large numbers upon a flexible plant on one side of a stream, until their weight causes it to bend to the other side. For courage and activity the soldiers have no equal; they know no fear, and when on duty they stand with their shiny black heads erect and forceps open, ready to seize on any passing animal. No horse, donkey, or dog, can be induced to cross their path, seeming to have an instinctive dread of them; and woe be to the individual, man or beast, who gets among them at night. If a twig is drawn through their ranks they instantly close their forceps upon it; and others in turn close upon their bodies and legs, till a mass of them is seen at the end of the stick looking like a bunch of curled hair.

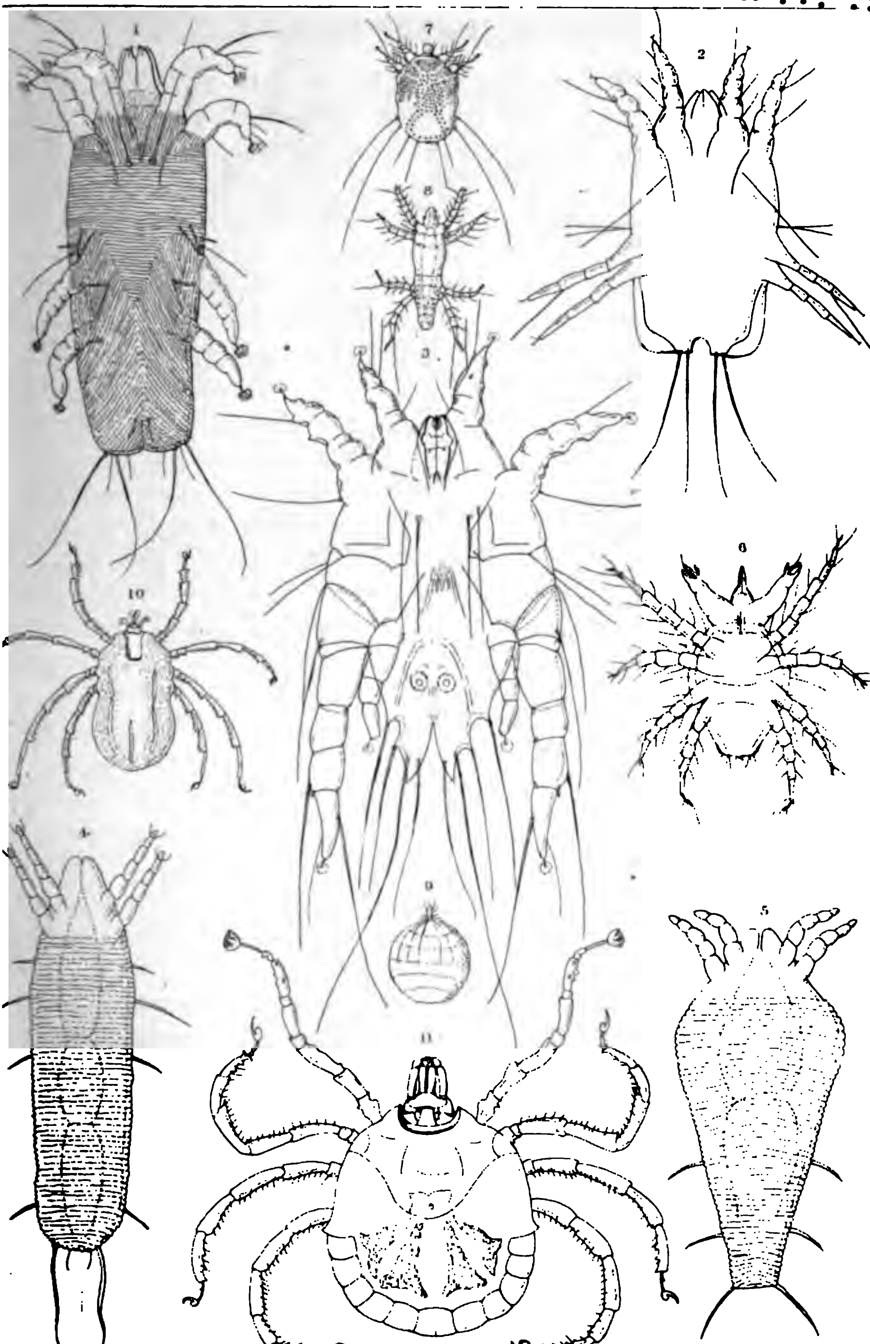
These insects have no eyes, but their sense of smell is very acute, for if the breath be blown on them from the distance of some feet, they are instantly in motion, running to and fro with the greatest speed, evidently aware of the approach of some living being. Though at times they are of great service in ridding our houses of cockroaches and other vermin, yet, when their haunt is near, their visits are much too frequent to be tolerated. Various methods are used to get rid of them, though often with but little success. When they are in large numbers in a small space, scalding water is, perhaps, the best method. By throwing straw or other combustible material upon them, and suffering them to overrun it (which they quickly do), they may then be destroyed by applying a match to the mass. Gunpowder,

also, is sometimes used in their holes; hot ashes, spirits of turpentine, and other articles of the same kind, are useful to turn them from their course. When a live coal is dropped in their way they immediately attack it, though hundreds may perish in doing so. They are very sensitive to the light of the sun, which is fatal to them. They seldom move during the day, and then only during cloudy days, choosing then the dark woods or thick grass. Their rate of progression is about two yards in a minute, and in their journeys from place to place they go from four to eight abreast. I have seen a stream of Drivers crossing an open path at six o'clock in the morning, and at six at night their number was undiminished. How long they had been passing before I saw them, or how long it continued, I am not able to say. Their path, from constant travel, became quite worn and smooth. The natives are very careful to remove all grass from the vicinity of their houses, as a means of keeping off these pests.

A CHAPTER ON MITES.

BY A. S. PACKARD, JR.

BUT few naturalists have busied themselves with the study of mites. The honored names of Hermann, Von Heyden, Dugés, Dujardin and Pagenstecher, Nicolet, Koch and Robin, lead the small number who have published papers in scientific journals. After these, and except an occasional note by an amateur microscopist who occasionally—not to speak too irreverently—pauses from his "diatomaniacal" studies, and looks upon a mite simply as a "microscopic object," to be classed in his micrographic Vade Mecum with mounted specimens of sheep's wool, and the hairs of other quadrupeds, a distorted proboscis of a fly, and podura scales, we read but little of mites and their habits. But few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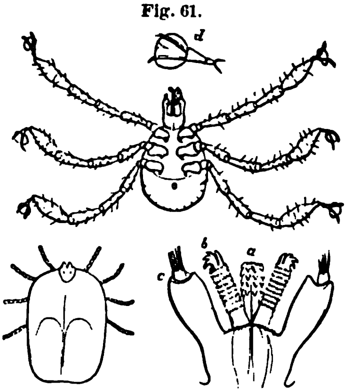
readers of our natural history text-books learn from their pages any definite facts regarding the affinities of these humble creatures, their organization, and the singular metamorphosis a few have been known to pass through. We shall only attempt in the present article to indicate a few of the typical forms of mites, and sketch, with too slight a knowledge to speak with much authority, an imperfect picture of their appearance and modes of living.

Mites are lowly organized Arachnids. This order of insects is divided into the Spiders, the Scorpions, the Harvestmen and the Mites (Acarina). They have a rounded oval body, without the usual division between the head-thorax and abdomen, observable in spiders; the head, thorax, and abdomen being merged in a single mass. There are four pairs of legs, and the mouth-parts consist, as seen in the adjoining figure of a young tick (Fig. 61, young *Ixodes albipictus* Pack.*), of a pair of maxillæ (*c*), which in the adult, terminates in a two or three-jointed palpus, or feeler; a pair of mandibles (*b*), often covered with several rows of fine teeth, and ending in three or four larger hooks, and a serrated labium (*a*). These parts form a beak which the mite, or tick, insinuates into the flesh of its host, upon the blood of which it subsists. While many of the mites are parasitic on animals, some are known to devour the eggs of insects and other mites, thrusting their beaks into the egg and sucking the contents. We have seen the mite (*Nothrus*) figured on the following page (Fig. 62) busily engaged in destroying the eggs of the Canker worm, and Dr. Shimer has observed the *Acarus? malus* sucking the eggs of the Chinch bug. While

Fig. 61.



* The figure at the bottom on the left represents the adult, fully-gorged tick.

a few mites are injurious to man, the larger part are beneficial, being either parasitic and baneful to other noxious animals, or more directly useful as scavengers, removing decaying animal and vegetable substances.

The transformations of the mites are interesting to the philosophic zoölogist, since the young of certain forms are remarkably different from the adults, and in reaching the perfect state the mite passes through a metamorphosis more striking than that of many insects. The young on leaving the egg are usually hexapodous, *i. e.*, have six legs, as we have seen in the case of the *Ixodes albipictus* previously noticed in the NATURALIST (Vol. ii, p. 559). Sometimes, however, as in the case of the larva, as we may call it, of a European species, *Typhlodromus pyri* (Pl. 6, fig. 4), the adult of which, according to A. Scheuten, is allied to Acarus, and lives under the epidermis of the leaves of the pear, there are but two pairs of legs present, and the body is long, cylindrical and worm-like. Plate 6, fig. 5 represents the four-legged larva of another species of Typhlodromus.

Fig. 62.

We have had the good fortune to observe the different stages of a bird mite, intermediate in its form between the Acari and Sarcoptes, or Itch-mite. On March 6th, Mr. C. Cooke called my attention to certain little mites (Pl. 6, fig. 1) which were situated on the narrow groove between the main stem of the barb and the outer edge of the barbules of the feathers of the Downy Woodpecker, and subsequently we found the other forms indicated in Plate 6, figs. 2 and 3, in the down under the feathers. These long worm-like mites were evidently the young of the singular Sarcoptes-like mite, represented by figs. 2 and 3 of the plate, as they were found on the same specimen of Woodpecker at about the same date, and it is known that the growth of mites is rapid, the metamorphoses occupying but a few days.

The larva (though there is, probably, a still earlier hexapodous stage) of this Sarcoptid has an elongated, oblong, flattened body, with four short legs, provided with a few bristle-like hairs, and ending in a stalked sucker, by aid of which the mite is enabled to walk over smooth, hard surfaces. The body is square at the end, with a slight median indentation, and four long bristles of equal length. They remained motionless in the groove on the barb of the feather, and when removed seemed very inert and sluggish. A succeeding stage of this mite, which may be called the pupal, is represented on Plate 6, fig. 2. It is considerably smaller than the larva (all the figures of this sarcoptid being drawn to one scale by Prof. A. M. Edwards, and magnified 115 diameters), and looks somewhat like the adult, the body having become shorter and broader. It is perhaps the pupa, or nymph. The adult (Pl. 6, fig. 3) is a most singular form, its body being rudely ovate, with the head sunken between the fore legs, which are considerably smaller than the second pair, while the third pair are twice as large as the second pair, and directed backwards, and the fourth pair are very small, not reaching the extremity of the body, which is deeply cleft, and supports four long bristles on each side of the cleft, while other bristles are attached to the legs and body, giving the creature, originally ill-shapen, a haggard, unkempt appearance. The two stigmata, or breathing pores, opĕn near the cleft in the end of the body, and the external opening of the oviduct is situated between the largest or third pair of legs. No males were observed. In a species of Acarus (*Tyroglyphus*), somewhat like the Cheese-mite, which we have alive at the time of writing, in a box containing the remains of a Lucanus larva, which they seem to have consumed, as both young and old are swarming there by myriads, the young are oval and like the adults, except that they are six-legged, the fourth pair growing out after a succeeding moult.

Such is a brief summary of what has been generally

known regarding the metamorphoses of a few species of mites. But a French naturalist, C. Robin, has recently observed in certain bird sarcoptids, to which the parasite of the Downy Woodpecker noticed above is allied, a still "more complicated series of phenomena; in these the males pass through four, and the females through five stages, indicated as follows: (1) the *egg*, on issuing from which the animal has the form of (2) a *hexapod larva*, followed by the stage of (3) *octopod nymphæ* [four-footed pupæ], without sexual organs. (4) From some of these nymphæ issue: *a*, *sexual males*, after a moult which is final for them; *b*, from others issue *females without external sexual organs*, resembling the nymphæ, but larger, and in some species furnished with special copulatory organs. Finally, after a last moult following copulation, these females produce (5) the *sexual and fecundated females*, which do not copulate, and in the ovary of which eggs are to be seen. No moult follows that which produces males or females furnished with sexual organs; but previously to this the moults are more numerous than the changes of condition." "The larvæ undergo from two to three moults before passing to the state of nymphæ." These latter also undergo two or three moults. (Annals and Magazine of Natural History, 1868, p. 78.)

In some other species of mites no males have been found, and the females have been isolated after being hatched, and yet have been known to lay eggs, which produced young without the interposition of the males. This parthenogenesis has been noticed in several species.

With their rapid increase in numbers these insects often suddenly appear in vast numbers on various articles of food, and about houses, so as to be very annoying. Mr. J. H. Gregory, of Marblehead, Mass., has found the mite figured on plate 6, fig. 6 (magnified 60 diameters), very injurious to the seeds of the cabbage, which it sucked dry. This is an interesting form and appears to belong to the genus Cheylutus. It is of medium size, and especially noticeable from

the tripartite palpi, which are divided into an outer, long, curved, clawlike lobe, with two rounded teeth at the base, and two inner, slender lobes pectinated on the inner side, the third innermost lobe being minute. The beak terminates in a sharp blade-like point.

We will now give a hasty glance at the different groups of mites, pausing to note those most interesting from their habits or relation to man.

The most highly organized mite (and by its structure most closely allied to the spider) is the little red garden mite, belonging to the genus Trombidium, to which the genus Tetranychus is also nearly related. Our own species of the former genus have not been "worked up," or in other words identified and described, so that whether the European *T. holosericeum* Linn. is our species or not, we cannot tell. The larvæ of this and similar species are known in Europe to live parasitically upon Harvest-men (*Phalangium*), often called Daddy-long-legs; and upon Aphides and other insects. The European *Tetranychus telarius* Linn., or web-making mite, spins large webs on the leaves of the linden tree. Then succeed in the natural order the water mites, Hydrachna, which may be seen running over submerged sticks and on plants, mostly in fresh water, and rarely on the borders of the sea. The young, after leaving the eggs, differ remarkably from the adults, so as to have been referred to a distinct genus (Achlysia) by the great French naturalist, Audouin. They live as parasites on various water insects, such as Dytiscus, Nepa and Hydrometra, and when mature live free in the water, though Von Baer observed an adult *Hydrachna concharum* living parasitically on the gills of the fresh-water mussel, Anodon. The species are of minute size.

Collectors of beetles often meet with a species of Uropoda attached firmly to their specimens of dung-inhabiting or carrion beetles. It is a smoothly polished, round, flattened mite, with short, thick legs, scarcely reaching beyond

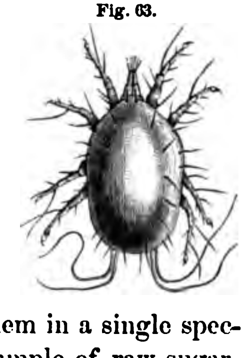
the body. We now come to the Ticks, which comprise the largest mites. The genus Argas closely resembles Ixodes. Gerstaecker states that the *Argas Persicus* is very annoying to travellers in Persia. The habits of the wood ticks, Ixodes, have been already referred to in the NATURALIST (Vols. ii, p. 559; iii, p. 51). Travellers in the tropics speak of the intolerable torment occasioned by these pests, which, occurring ordinarily on shrubs and trees, attach themselves to all sorts of reptiles, beasts and cattle, and even man himself as he passes by within their reach. Sometimes cases fall within the practice of the physician, who is called to remove the tick which is found sometimes literally buried under the skin. Mr. J. Stauffer writes me, that "on June 23d the daughter of Abraham Jackson (colored), playing among the leaves in a wood, near Springville, Lancaster County, Penn., on her return home complained of pain in the arm. No attention was paid to it till the next day, when a raised tumor was noticed, a small portion protruding through the skin, apparently like a splinter of wood. The child was taken to Dr. Moreney, who applied the forceps, and after considerable pain to the child, and labor to himself, extracted a species of Ixodes, nearly one-quarter of an inch long, and of an oval form and brown mahogany color, with a metallic spot, like silver bronze, centrally on the dorsal region." This tick proved, from Mr. Stauffer's figures, to be, without doubt, *Ixodes unipunctata* Pack. (Pl. 6, fig. 11, enlarged). It has also been found in Massachusetts by Mr. F. G. Sanborn.

Another species is the *Ixodes bovis* Riley (Pl. 6, fig. 10), the common cattle tick of the Western States and Central America. It is very annoying to horned cattle, gorging itself with their blood, but is by no means confined to them alone, as it lives indifferently upon the rattlesnake, the iguana, small mammals, and undoubtedly any other animal that brushes by its lurking-place in the forest. It is a reddish, coriaceous, flattened, seed-like creature, with the body

oblong oval, and contracted just behind the middle. When fully grown it measures from a quarter to half an inch in length. We have received it from Missouri, at the hands of Mr. Riley, and Mr. J. A. McNiel has found it very abundantly on horned cattle on the western coast of Nicaragua. We now come to the genus Acarus (Tyroglyphus), of which the cheese and sugar mites are examples. These, and their allied forms, are among the most lowly organized of the Arachnids, and seem to connect the spiders with the Crustacea, the sea-spiders (Pycnogonids) bearing a remarkable resemblance to certain mites. Some species of Acarian mites have been found in the lungs and blood-vessels, and even the intestinal canal of certain vertebrates, while the too familiar itch insect lurks under the skin of the hand and other parts of the body of uncleanly human bipeds.

Many people have been startled by statements in newspapers and more authoritative sources, as to the immense numbers of mites (*Acarus sacchari*, fig. 63) found in unrefined or raw sugar. According to Prof. Cameron, of Dublin, as quoted in the "Journal of the Franklin Institute," for November, 1868, "Dr. Hassel (who was the first to notice their general occurrence in the raw sugar sold in London) found them in a living state in no fewer than sixty-nine out of seventy-two samples. He did not detect them in a single specimen of refined sugar. In an inferior sample of raw sugar, examined in Dublin by Mr. Cameron, he reports finding five hundred mites in ten grains of sugar, so that in a pound's weight occurred one hundred thousand of these little creatures, which seem to have devoted themselves with a martyr-like zeal to the adulteration of sugar. They appear as white specks in the sugar. The disease known as grocer's itch is, undoubtedly, due to the presence of this mite, which, like its ally the Sarcoptes, works its way under the

Fig. 63.



skin of the hand, in this case, however, of cleanly persons. Mr. Cameron states that "the kind of sugar which is both healthful and economical, is the dry, large-grained, and light-colored variety."

Closely allied to the preceding, is the Cheese-mite (*Acarus siro* Linn.), which often abounds in newly made cheese. Lyonet states that during summer this mite is viviparous. *Acarus farinæ* DeGeer, as its name indicates, is found in flour. Other species have been known to occur in ulcers.

The itch insect (*Sarcoptes scabiei* DeGeer, Pl. 6, fig. 7) was first recognized by an Arabian author of the twelfth century, as the cause of the disease which results from its attacks. The body of the insect is rounded, with the two hind pair of feet rudimentary and bearing long hairs. It buries itself in the skin on the more protected parts of the body, and by its punctures maintains a constant irritation. Other species are known to infest the sheep and dog.

Fig. 64.

Another singular mite is the *Demodex folliculorum* (Fig. 64), which was discovered by Dr. Simon, of Berlin, buried in the diseased follicles of the wings of the nose in man. It is a long slender worm-like form, with eight short legs, and in the larva state has six legs. This singular form is the lowest and most degraded of the order of Arachnids. We figure on plate 6, figs. 8 and 9, greatly enlarged, a most singular mite, discovered by Newport on the body of a larva of a wild bee, and described by him under the name of *Heteropus ventricosus*. Fig. 8, in the plate, represents the body of the fully formed female. After attaining this form, its small abdomen begins to enlarge until it assumes a globular form (Fig. 9), and the mass of mites look like little beads. Mr. Newport was unable to discover the male, and thought that this mite was parthenogenous. It will be seen that the adult Demodex retains the elongated, worm-like appearance of the larva of the higher mites, such as Typhlodromus. This is an indication of its low rank, and hints of a relation-

ship to the Tardigrades and the Pentastoma, the latter being a degraded worm, living parasitically within the bodies of other animals.

EXPLANATION OF PLATE VI.

Fig. 1. Larva of a bird mite, *Dermaleichus*.
Fig. 2. Pupa (?) of the same.
Fig. 3. Adult female of the same.
Fig. 4. Larva of *Typhlodromus pyri* Scheuten. (From Scheuten.)
Fig. 5. Larva of another species of *Typhlodromus*. " "
Fig. 6. *Chelytus* (probably undescribed).
Fig. 7. *Sarcoptes scabiei* DeGeer. (From Gervais.)
Fig. 8. *Heteropus ventricosus* Newport, fully-formed female. (From Newport.)
Fig. 9. *Heteropus ventricosus* Newport, gravid female. (From Newport.)
Fig. 10. *Ixodes bovis* Riley.
Fig. 11. *Ixodes unipunctata* Packard.

THE FRESH-WATER AQUARIUM.

BY C. B. BRIGHAM.

(Continued from page 212.)

THE question is often asked what kinds of plants are the best for the aquarium, and where are they found? Most writers on this subject give long lists of plants, which are useless to those who are unacquainted with the botanical names. To the majority of people not even the common names of most water plants are known, and to such it becomes very perplexing to make a selection from a list bare of any description. Although it is insisted by some that the tank should not be filled with every kind of plant that the collector can obtain, yet it seems as if there was no sound reason why all the plants that flourish in the aquarium should not be placed therein. In a properly managed aquarium there are very few water plants which will not do well; the few exceptions being found in the lilies, which require a

deeper soil than is convenient in the tank, and in those plants accustomed to a lower temperature of the water than is easy to maintain. Apart from these take any of the green plants found in ponds, and placing them in the tank, watch their growth, and a few weeks' trial will determine their value whether they are of use or for ornament. It is hardly practicable to arrange the plants in the tank in botanical order, the room is so limited. A better way, if we wish such an arrangement, would be to devote a separate tank to each variety. This could easily be done in what is called the cabinet aquarium, which will be noticed hereafter. An affair of this sort enables one to have a large collection of plants, changing the light or temperature as the case requires.

Before giving the names of a few of our native plants which are favorites in the aquarium, it may be well to say a few words as to the locality in which most are found, for to one who takes a real interest in the aquarium, it will not suffice to pick out a few plants here and there from the collections of dealers in specimens, which by the way are not numerous. Half of the pleasure, to say nothing of the profit in having an aquarium, is in hunting for one's own specimens, and in realizing that there is much more life in the waters of a pond than we before imagined. To those who pass some time during the year in the country, there will be ample means for collecting specimens in the ponds near by; but to residents of cities the task will not be so easy, although it will depend a good deal upon the facilities for getting into the country. Take for example the two cities of Boston and Worcester. A ride of fifteen minutes in the steam cars will take one from the former place to Fresh Pond, in Cambridge, which is rich in aquarial specimens. The brooks in the marshes, near what is called the "Glacialis," abound in larvæ, fresh-water snails, and the smaller specimens, while Fresh Pond itself contains nearly all our common water plants. Tritons, or fresh-water newts, are

not to be found there, but not so with small turtles, which at certain seasons of the year, especially in the fall, are quite common. There is, I believe, no place equally near Boston, which has so complete a collection of aquarial specimens as Fresh Pond. Worcester offers great advantages to the collector in its beautiful Long Pond, or, as it is recently called, Lake Quinsigamond. The pond itself has few plants on account of its depth, but if we follow it up to the river which helps to form it, and then to the other pond above, near the place where a few years ago the old mill house stood, we shall find all the specimens we could wish for. In this upper pond the plants, instead of growing with the various kinds, mingling recklessly together as usual, are found in a general way, with each kind in a large patch by itself as if some one had planted them so, making as it were an aquatic botanical garden. We may go in the opposite direction down the pond, a few miles below the bridge which crosses it, until we come to the dam which separates Long from what is called Half-moon Pond. If it is midsummer, and early in the morning, we shall find ourselves surrounded by acres of water-lilies, beneath which are the desired specimens. All along from this dam, towards Grafton, a chain of shallow ponds connected by rivers invites our attention, and the scenery alone would be a sufficient inducement to bring the naturalist to the spot. The three kinds of plants which are the best suited for the aquarium, of all our natives, are *Ceratophyllum demersum; Utricularia vulgaris, inflata,* and *minor; Potamogeton natans, Claytonii,* and others.*

*They are thus described by Dr. Gray. (Manual of Botany of the Northern States. By Asa Gray. 1867.)

"*Ceratophyllum:* Hornwort. Sterile flowers of 12–24 stamens, with large sessile anthers. Fruit an achemium, beaked with the slender persistent style. Herbs growing under water in ponds or slow flowing streams. The sessile leaves cut into thrice-forked thread-like rigid divisions (whence the name from κέρας, a horn, and φυλλον, a leaf)."

"*Utricularia:* Bladderwort. Lips of the 2-parted calyx entire or nearly so. Corolla personate, the palate on the lower lip projecting, often closing the throat. Anthers convergent, aquatic and immersed, with capillary dissected leaves bearing little blad-

Besides these plants the floating Duckweed (*Lemna trisulca*) is a very valuable addition to the collection. Water-lily plants are not only difficult to make grow, but their leaves are apt to be ill-proportioned to the size of the tank. In duckweed both these troubles are done away with, for we have a plant which is easily grown, and one which gives to the aquarium the appearance of a miniature pond. It is found in brooks at the roadside and in shallow ponds, especially in the autumn season. The *Limnocharis Humboldtii*, a lily sometimes grown in tanks in greenhouses, is also a good plant for the aquarium, where, if care be taken, it will blossom freely. There is a moss-like plant of bluish green color, found growing on stones in brooks, and under bridges in shady places in the water. It is called *Fontinalis antipyretica*, and it is one of the few brook plants that will do well in the aquarium. The water buttercup, *Ranunculus aquatilis*, has only its beauty to recommend it, for it hardly survives the winter in the tank. A plant of the Frog's-bit family, *Anacharis Canadensis*, is another excellent one for the aquarium. It gives to the fresh-water aquarium an appearance similar to that which the *Ulva latissima* gives to the marine tank.

Having made a collection of plants, and thoroughly washed them, the next thing is to arrange them in the tank. This arrangement must be according to the taste of the collector. One way, perhaps as good as any, is to make four bunches of plants of suitable size, and place one in each corner of the tank if it is rectangular; they do not then ob-

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ders, which are filled with air and float the plant at the time of flowering; or rooting in the mud, sometimes with few or no leaves or bladders (name from *Utriculus*, a little bladder)."

"*Potamogeton*: Pond-weed. Flowers perfect. Sepals 4, rounded, valvate in the bud. Stamens 4, opposite the sepals; anthers nearly sessile, 2-celled. Ovaries 4 (rarely only one), with an ascending campylotropous ovule. Stigma sessile, or on a short style. Fruit drupe-like when fresh, more or less compressed; endocarp (nutlet) crustaceous. Herbs of fresh or one in brackish ponds and streams, with jointed, mostly rooting stems, and 2-ranked leaves, which are usually alternate or imperfectly opposite. The submersed ones pellucid, the floating ones often dilated and of a firmer texture (an ancient name composed of ποταμός, a river, and γείτων, a neighbor, from their place of growth)."

struct the view of the tank; they take up the room which is the least valuable of any, and yet can be seen to great advantage. As the plants grow the tops of the branches meet and form an arch of green on all sides of the rockwork in the centre. They may be held in position, as was suggested by a friend, by fastening to them, by a thread or fine piece of string, a small stone of sufficient weight to anchor the plants and keep them in place. If this is not done, and the plants left to themselves or with the ends of their stems simply held down by a stone placed over them, we shall find them continually being turned upside-down by the mussels, turtles, or other live stock of the aquarium.—*To be continued.*

REVIEWS.

THE INJURY DONE TO FORESTS BY INSECTS.*—Before giving our readers an idea of the contents of these volumes, we must first express the delight and wonder we have felt at the industry and skill exhibited in this magnificent work. It is a thorough monograph of the natural history of the forest insects, and the injury done by them to forest trees in Germany, by one of the best of living naturalists, who, by his previous works on Forest Insects (Die Forstinsecken, 1839-44), has, more than any other writer perhaps in Europe, built up the science of economical entomology. It is of the class of works to which Audouin's superb, and now very rare, volume on the insects of the Vine, Curtis' Farm Insects, Boisduval's recent work on horticultural entomology, and Harris' Insects of Massachusetts injurious to vegetation, are examples. Such works as these are an honor to any state or country, and do more to bring abstract scientific studies into favor with the masses, demonstrating the direct money value of the labors of the naturalist, than any other class of books. In the elaborate and beautifully executed plates that enrich the two volumes before us is reproduced the tree as it stands in the forest, gnarled and distorted by one set of insects, its leaves curled and turned yellow, or red, by the attacks of others, with certain branches stripped by still others; and not only are certain trees and shrubs thus represented in colors, but some of the plates represent parts of a forest, showing the

* Die Waldverderbniss oder dauernder Schade, welcher durch Insektenfrass, Schalen Schlagen und Verbissen an lebenden Waldbaumen entsteht. Von Dr. J. T. C. Ratzburg. 2 vols, 4to. Berlin, 1866-'68. With fifty-seven plates and numerous wood-cuts. $20.00 in gold.

injury done in the mass by one or two insects. To give one example in illustration, from among the fifty-seven plates contained in the two volumes, plates five and six contain twenty-one figures, showing the injury done by the *Bombyx pini* and *B. monacha* to the pine, and the changes in the form of the branches and leaves for several years succeeding the defoliation, and the after growth of different branches depending on the different degrees of injury, with transverse sections of the twigs, and microscopic sections illustrating the pathological anatomy of the tree; all the points being illustrated in the figures and discussed in the text with a minuteness and care that are almost incredible for one man to have accomplished.

We would speak most enthusiastically of the work, because we have not often been so impressed by the labors of a single man, who has already published so much. It will give a new impetus to economical entomology, and we hope the work will meet with a wide circulation in this country, where the same injuries are produced by analogous insects, and perhaps greater losses are sustained from the attacks of insects than even in Europe. Such a work on fruit trees, field and garden vegetables, is now demanded, before the whole subject of economical entomology will have been thoroughly discussed.

HAND-BOOK OF ECONOMIC ZOÖLOGY FOR AGRICULTURISTS.*—Another book, by the same author, for still more general circulation, is, as its title runs, "the forest-destroyers and their enemies, or a description and illustration of injurious forest insects and animals generally destructive to forests, with advice as to the means of their extermination, and for the protection of their enemies. A hand-book for foresters, gardeners, etc." It is perhaps the most comprehensive work on economic zoölogy yet published, and a perfect treasury of information regarding all the varied relations of animals (especially insects) destructive to forests.

RECORD OF AMERICAN ENTOMOLOGY FOR 1868.†—After unforseen delays this long promised year-book has appeared, and we trust that entomologists will feel inclined to purchase a copy, if for no other reason than to aid in the establishment of a yearly record of their labors, which cannot fail to develop new students of entomology, and stimulate those already at work. The Editor has been assisted by Mr. S. H. Scudder, Baron Osten Sacken, Dr. J. L. Leconte, Mr. P. R. Uhler and Dr. H. Hagen. The present "Record" contains, with two exceptions, no references to papers published in European Scientific journals, as copies were not obtained in time to be noticed. It is therefore in this respect imperfect, but such papers will be noticed in the "Record" for the succeeding year. The Editor, therefore, in his preface requests European entomologists to send, promptly, separately printed copies of such papers as relate to American insects, to the Editor, Dr. A. S. Packard, Salem,

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* Sixth edition, enlarged and improved. With seven colored and plain copper plates, lithograph plates, wood cuts, and insect calendars, etc., etc. 8vo, Berlin, 1869. $4.00 gold.

† Salem, Naturalist's Book Agency. 8vo, pp. 60. Price $1.00.

Mass., that their labors may be recorded, and the "Record" be made more complete. Four hundred and two new species are described from North (including Central) America, and Dr. Hagen briefly describes four new false scorpions. The "Record" refers to notices and articles by forty-five different writers.

A LEPIDOPTERIST'S GUIDE.*—This is a very comprehensive and compact guide for the study of butterflies and moths, and with but few changes would answer for the use of collectors in this country. We advise every lepidopterist to provide himself with a copy.

GUIDE TO THE STUDY OF INSECTS.†—The eighth part of the "Guide" has appeared; two more parts will finish the work, and the ninth part will appear in August. The tenth part (completing the work) will contain a glossary, a calendar of the appearances of insects, and a full index. The present part nearly completes the chapter on Coleoptera, and is illustrated by 114 wood cuts, about half of which represent the early stages of beetles, some of which have not before been published.

THE PEABODY MUSEUM OF AMERICAN ARCHÆOLOGY AND ETHNOLOGY.‡—Prof. Wyman, the curator, reports that the collections have been increased by the addition of from four to five thousand specimens. It is a matter of congratulation that two very valuable collections of European antiquities have been bought and are now in the possession of this museum. The first is that of Gabriel de Mortillet, made in France, and that of Wilmot J. Rose, made in Denmark. The first illustrates the early condition of the human race in France, with objects belonging to some of the analogous periods from other countries, especially Switzerland and Italy, and comprises about 3000 specimens, mostly representing the Age of Stone, and the Age of Metals. The Rose collection "comprises 1559 specimens, of which about fifty are of bronze or iron, a few of bone, and the rest of stone, mostly flint." The Curator remarks, "with the acquisition of the collection just referred to, from Denmark, the Mortillet collection from France, and the Clement collection from Switzerland, the Peabody Museum has accomplished one of its more important objects, viz., the gathering of the means for making direct comparison between the implements of the Stone Age of the old world and the new."

THE PEABODY ACADEMY OF SCIENCE.§—This report contains the history of the organization of the Academy, and of the preliminary arrangement of the Museum, formed by the union of the collections of the Essex

*The Lepidopterist's Guide, intended for the use of the young collector, containing full instructions for the Collecting, Management, Observation and Preservation of Lepidoptera in all their stages. By H. Guard Knaggs, M. D. London: Van Voorst, 1869. 12mo, pp. 122. 50 cents, gold.

†A Guide to the Study of Insects, etc. By A. S. Packard, Jr., M. D. Salem: Naturalist's Book Agency. London: Trubner & Co. Part viii, pp. 64. June, 1868. Price 50 cents a part. To be published in ten parts.

‡Second Annual Report of the Trustees. Boston, 1869. 8vo, pp. 23.

§First Annual Report of the Trustees, etc. Salem, 1869. 8vo, pp. 103.

Institute and the East India Marine Society, and the Director of the Museum (F. W. Putnam) gives a description and plans of the arrangement of the Hall and cases, and of the arrangement of the different classes of specimens both on the floor and in the galleries. The report of the proceedings of the trustees is followed by a report of the Council, containing reports of the Director and Curators, with an appendix, entitled "List of Hymenopterous and Lepidopterous Insects collected by the Smithsonian Expedition to South America, under Prof. James Orton, by A. S. Packard, jr." The Formicidæ enumerated are named by Mr. Edward Norton. Mr. E. S. Morse, in the appendix to his report on the condition of the Mollusca, describes *Actinobolus* (Cyclocardia) *Novangliæ* as an Essex county shell, which he separates from *Cardita borealis*, and illustrates the difference by wood cuts. There is also appended a report by Mr. J. A. McNiel on his expedition to Central America, and the Director and Curators report a proposed plan of operations for the Academy, (prepared by Mr. A. Hyatt), in which is suggested a Survey of the Physical and Natural History of Essex County. The following votes by the Council are recorded:

Voted, "That in labelling the collections all nouns used as specific names, and specific names when derived from proper names shall be written with capital initial letters, and also, that the same rule shall obtain in the official publications of the Academy." It was also further voted, "that in labelling the collections, the name of the person who first united the generic and specific appellations shall be given as the authority for the name, and that when the name of the original describer of the species is given, it shall be in parenthesis."

NATURAL HISTORY MISCELLANY.

BOTANY.

Flowering of Posoqueria.—In the October number of the Naturalist (1868), was given on page 437, and following, an account of the phenomena displayed in flowering by a species of Posoqueria in the Botanic Garden here; and a comparison of them with similar ones exhibited by a species of the same genus as witnessed and described by Mr. Fritz Müller, in the island of Santa Catarina on the Coast of Brazil. I felt convinced then, and am so still, that we had the same plant in view. Not the slightest essential difference can be discovered between our plant and the figures of his. I stated—doubtfully, it is true, because my experiments had not been so numerous as his, and because I had made a slight omission of one particular as conducted by him—that I thought he was mistaken in his view of the mechanism of the phenomenon. The plant is now in flower, and has given me the opportunity to test the irritability, if such there be, at the point indicated by him. I faithfully tickled the upper filaments at the curvature without the least effect, except in one instance, when the anther mass burst asunder during the experiment. But it might have been near the time when they explode in

the progress of the flower from expansion towards decay, as they always do sooner or later, whether through the aid of an insect or not. I feel perfectly convinced that the titillation, by the legs of small or even large insects, of the filaments is not *the* mode of effecting the explosion of the anther mass. On the other hand *abundant* experiments have shown that a slight pressure upon this mass *is* effectual, and uniformly so to the diffusion of the pollen.

In a short time we shall have more flowers, and we would be pleased to show it to any who take an interest in such phenomena; and we will be more than pleased if any one skilful in such matters will make a thorough anatomical examination of the mechanism by which it is effected. —CHARLES WRIGHT.

A WHITE ARETHUSA.—June 6th, '69, a friend sent me from Plymouth, Mass., hundreds of the *Arethusa bulbosa* in blossom; among them was a pure *white one.* The specimen, which was an unusually fine one, was found growing in the open sunshine in a swamp covered for an acre in extent with the usual high-colored ones. I myself found the same freak of nature at Lexington last year, and carried the plant to Dr. Gray, who told me it was the first *white Arethusa* he had ever seen, though he often met albinos of other families of plants on his botanical rambles.—C. A. B., *Cambridge, Mass.*

ABNORMAL FORMS OF PLANTS.—As much enquiry has of late been directed to variation in plants, particularly in those growing in a wild state, removed from any influence of cultivation, I would contribute from my own observations the following facts on the subject:

A remarkable form of *Fragaria Virginiana* var. *Illinoensis* Gray, was found by me last summer, in abundance, in two localities on Lake Superior, remote from culture. The petals had changed, or were partially altered to stamens, in most instances the transformation being complete. The singularity of the plant was apparent at a glance. This is an interesting case for a Darwinian, as it would appear that this plant, not satisfied with the variation it had previously accomplished, was still demonstrating its inclination to progress! I inclose a specimen. A strange form of *Viola blanda* Willd., which I found growing on wooded mountain slopes, was of unusually large size, the great reniform leaves were matted with dense hair, which also clothed the petioles, peduncles, etc. A variety of *V. Selkirkii* (Pursh) Goldie, having the leaves less hairy, and with a pale grayish blue corolla, unmarked with purple streaks and with more white than usual, grew not unfrequently with the ordinary form in open woods. *Trifolium repens* Linn., flourished in open patches on mountain slopes, having its leaves often from four to six-foliate. This was casting the four-leaved shamrock into the shade. Deep in the forest I encountered *Mitchella repens* Linn., with, in many cases, its corolla six to seven-lobed. I also discovered a single instance of *Botrychium Virginicum* Swartz., with a second perfect though smaller fertile frond rising on an independent stalk from the centre of the largest primary division of

its sterile frond. The smallest divisions of the sterile frond were, a few of them, changed to fertile clusters. In this connection I would state that a smaller, delicate form of *B. lanceolatum* Angström, having the sterile segment less dissected, appears to me a decided variety. I have collected both forms on Lake Superior.

The remarks in the February number on *Onoclea sensibilis* var. *obtusilobata* Torr., lead me to say that this variety was found by me some seasons ago on the banks of the Bloody Run, Detroit. To my observation it is quite rare. Mr. Crittenden's plant does not seem to me to differ essentially from mine, in which some of the segments of the pinnæ are much contracted and revolute, though most of them preserve the foliaceous character, particularly at and towards the summit of the frond. Intermediate states and partially developed forms would naturally be expected.

To the white varieties, or albinos, which I have already noticed I would add the following, since contributed to my list: *Cirsium [illegible]* Michx., abundant in 1868, and the rare *Arethusa bulbosa* Linn., and *Calopogon pulchellus* R. Brown, in former years. HENRY GILLMAN, *Detroit*.

DOUBLE THALICTRUM ANEMONOIDES. — Enclosed is the photograph of a double flower of the *Thalictrum anemonoides* Michx. I found it in the woods at "Cedar Ridge," a locality known to all readers of the NATURALIST who have been in Poughkeepsie. It was growing in the midst of other plants of the usual form of *T. anemonoides*. Every stamen and pistil was transformed, so that the flower was completely double, and both for its exceeding and exquisite beauty, and the rarity of such a natural flower, I had its picture taken. M. M. SHATTUCK, *P[illegible]*.

BOTANICAL NOTES. — The mention of certain species in your botanical notes has reminded me of an individual of *Trillium [illegible]* [illegible] gathered here, having the parts in fours, viz.: four leaves, four sepals, four petals, and eight stamens. I have never met with another, and do not know whether such variation is common or not. Also of the occurrence of [illegible] and several other northern species on Kennebecasis Bay. Altogether, we know of the occurrence in this Province and [illegible] Eastern and Northern Maine, of twelve arctic and subarctic species [illegible] boreal or high northern, ranging by Lake Superior to the Arctic [illegible] and sixteen western or continental species, rare or wanting in the United States, east of New York. G. F. MATTHEWS, *St. John, N. B.*

IS THE [illegible] A NATIVE PLANT? — Looking over the NATURALIST [illegible] March, 18[illegible], I find that an enquiry has been made whether [illegible] [illegible] native plant. If the question is not already settled, [illegible] be useless to state, even at this day, that both that and [illegible] Western representatives are common in Washington Territory and Oregon, and that one of them, if not both, extend as far South at least as Humboldt Bay, California, where I have seen a tree as large round as a man's thigh. GEORGE GIBBS, *New York*.

ZOÖLOGY.

NORTH ATLANTIC DREDGING EXPEDITION.—On page 278 (paragraph next to last) of the July number of the NATURALIST, reference is made to deep sea-dredging by Dr. Carpenter and Wyville Thompson, of England, a government steamer having been placed at their disposal for the purpose. Upon the back of a letter recently received from my friend Dr. P. P. Carpenter, of Montreal, he writes that "*Buccinum undatum* was found living at a depth of 1300 fathoms!! by my nephew and J. G. Jeffreys, on H. M. ship Porcupine." The donkey-engine was used to hoist the dredge.

The deep-sea dredging operations of the late Prof. Edward Forbes, of Sars, and MacAndrew, disclosed facts entirely inconsistent with the theory that prevailed previous to their investigations, in reference to the depth below the surface of the sea at which animal life could exist. With the data already in our possession, it is highly probable that farther investigations will show still more surprising results, and that life will be found to exist at depths greatly exceeding that mentioned by Dr. Carpenter. Humboldt, climbing Chimborazo, found flies buzzing around him at a height of over 18000 feet, and scientific research may yet show life from an equal depth below the sea-level.—R. E. C. STEARNS.

PARASITES OF ASCIDIANS.—In the Ascidians of Northern Europe a great number of parasitic Crustacea, mostly small Entomostracas, have been observed. Some of these are of peculiar interest, but in this country very little attention has been devoted to this subject. In dissecting a specimen of the commonest Ascidian (*Ascidia callosa*) of the coast of Maine recently, I found in the interior an interesting amphipod Crustacean, not yet determined specifically. Its length is about a quarter of an inch. Doubtless many other species of Crustaceans might be found by carefully searching this and other common Ascidians. Dr. Stimpson, in his "Shells of New England," p. 12, observes that in Europe the species of Crenella (*Modiolaria*) have the habit of burrowing in the test of Ascidians, while on this coast the same species do not have this habit. We found, however, at Eastport last season, a specimen of *Ascidia callosa*, with a small specimen of *Modiolaria discors* completely embedded in its test.—A. E. VERRILL.

LABRADOR DUCK.—In the August (1868) NATURALIST, A. R. Y. mentions that the Pied or Labrador duck, was shot on Long Island last winter. I would be much obliged to A. R. Y. if he would let me know if the specimens shot were full-plumaged males, and who has them? This is a very interesting bird to the naturalist, from the fact of its being so rare, and I had almost begun to think the bird had left us, as I had not heard of a full-plumaged male being taken for ten years. I have been shown two which were taken for the young, but one was a young albino Scoter, and the other I did not know. Not many years ago it was a common bird all along our coast, from Delaware to Labrador; and in the New York market there would at times be dozens of them; and then for a few years not

one. It would be very interesting to know where they have gone. Though so much has been learned of the distribution, summer and winter homes of birds within a few years, their breeding habits, line of travel north and south, and from the numerous collectors who have gone to Labrador, the fur countries and across the continent; yet not one word is said about the Labrador duck, a common bird a few years ago. So good a flyer and diver cannot be extinct like the clumsy *Alca impennis* (Great Auk) and any collector who may take a full-plumaged bird, or knows where they have gone, by letting it be known in the NATURALIST, would interest many of its readers. — GEO. A. BOARDMAN, *Milltown, Me.*

WINTER BIRDS OF NEW YORK. — I send you the following list of birds seen in the vicinity of Utica, N. Y., throughout the winter of 1868–9. — Pine Grosbeak (*Corythus enucleator*), have seen several flocks in the streets of the city. Barred Owl (*Syrnium nebulosum*), very common. Mottled Owl (*Scops asio*), not uncommon. Snow Bunting (*Plectrophanes nivalis*), very common after a snow storm. Lapland Bunting (*Plectrophanes Lapponicus*), not common. Snow Bird (*Fringilla Hudsonia*), common, in severe weather becoming half domesticated. Common Crossbill (*Loxia curvirostra*), common, though seldom seen out of the coniferous forests. White-winged Crossbill (*Loxia leucoptera*); this species, though often seen, is much rarer than the former. Cedar Bird (*Bombycilla Carolinensis*), not common. Lesser Redpoll (*Linaria minor*), abundant during autumn and winter. Downy Woodpecker (*Picus pubescens*), very common. Hairy Woodpecker (*Picus villosus*), not very abundant. White-breasted Nuthatch (*Sitta Carolinensis*), very abundant. Black-cap Tit (*Parus atricapillus*), the commonest of our winter [illegible]. American Crow (*Corvus Americanus*), common. Blue Jay (*Cyanura cristata*), not common. Canada Jay (*Perisoreus Canadensis*), uncommon. Ruffed Grouse (*Tetrao umbellus*), common, but becoming rarer every year. Red-tailed Hawk (*[illegible]*), common. Golden-eye Duck (*[illegible]*), rare, I have seen but one individual this winter. — C. L. WILLIAMS, *Utica, N. Y.*

PRESERVATION OF BIRDS' EGGS. — Allow me to suggest a method that I now invariably employ. Instead of the two holes to blow the eggs, I make one hole in the centre of the side of the egg, always selecting the side that is the least spotted, or the most so, as any particular [illegible] suggests. It should be made by an egg-drill, such as is furnished by the Smithsonian Institution, and at natural history stores. It is like a carpenter's countersink, only much finer. After making the hole, if the egg is fresh, force the contents with a small glass syringe; if nearly hatched, draw the parts through the opening with a fine hook, made of a fine needle set in a handle, and cut as fast as drawn with a thin sharp pair of scissors. With the syringe all liquid may be drawn nicely. I drew last summer thirty crow blackbirds' eggs in as many minutes, and did not hurry either. Is there any objection to my method? — BALDWIN COOLIDGE, *Lawrence, Mass.*

ON THE EARLY STAGES OF BRACHIOPODS.—The writer made a visit to Eastport, Maine, early in the summer, for the purpose of discovering the early stages of a species of Brachiopod (*Terebratulina septentrionalis* Couth.) so abundant in those waters. As little has been known regarding the early stages of this class of animals the facts here presented will be of interest, as settling beyond a doubt their intimate relations with the Polyzoa. As the subject will be fully presented at the meeting of the American Association, only the more important features will be mentioned here. In a few individuals the ovaries were found partially filled with eggs. The eggs (Fig. 65) were kidney shaped, and resembled the statoblasts of Fredericella. No intermediate stages were seen between the eggs and the form represented in Fig. 66. This stage recalled in general proportions Megerlia or Argiope in being transversely oval, in having the hinge-margin wide and straight and in the large foramen.

Fig. 65. Fig. 66. Fig. 67. Fig. 68. Fig. 69. Fig. 70. Fig. 71.

Between this stage and the next the shell elongates until we have a form remarkably like Lingula (Fig. 67), having, like Lingula, a peduncle longer than the shell, by which it holds fast to the rock. It suggests also in its movements the nervously acting Pedicellina.

In this and the several succeeding stages, the mouth points directly backward (forward of authors), or, away from the peduncular end (Fig. 68), and is surrounded by a few ciliated cirri, which forcibly recall certain Polyzoa. The stomach and intestine form a simple chamber, alternating in their contractions and forcing the particles of food from one portion to the other. At this time also the brownish appearance of the walls of the stomach resembles the hepatic folds of the Polyzoa. Fig. 69 shows a more advanced stage, where a fold is seen on each side of the stomach; from this fold the complicated liver of the adult is developed, first, by a few diverticular appendages, as seen in Fig. 70.

When the animal is about one-eighth of an inch in length the lophophore begins to assume the horseshoe shaped form of Pectinatella and other high Polyzoa. The mouth at this stage (Fig. 70) begins to turn towards the dorsal valve (ventral of authors), and as the central lobes of the lophophore begin to develop, the lateral arms are deflected as in Fig. 71. In these stages an epistome is very marked, and it was noticed that the end of the intestine was held to the mantle by attachment, as in the adult, reminding one of the *funiculus* in the *Phylactolæmata*. No traces of an anus were discovered, though many specimens were carefully exam-

ined under high powers for this purpose, the intestine of the adult [illegible] repeatedly ruptured under the compressor without showing any evidence of an anal aperture. EDWARD S. MORSE.

SARCOPSYLLA PULEX PENETRANS.—Having had some personal acquaintance with the doings of this insect, allow me to make a few [illegible] vations suggested by the account of it in the [illegible] Webster [illegible] Insects," p. 390. "The best preventatives [illegible] and the constant [illegible] against its attacks are cleanliness, and the [illegible] of boots when out of doors [illegible] slippers when in the house, and of [illegible] in the habit of going entirely barefooted [illegible]

As I was not in the habit [illegible] whether I would have been more troubled by the [illegible] French [illegible] nigger [illegible] or chigoe or chigue [illegible] with shoes or with shoes [illegible] almost any sort of [illegible] than with shoes [illegible] how much [illegible] and as I never wore boots I am not sure [illegible] would have offered in either case [illegible] in general [illegible] that I was [illegible] at times hardly [illegible] dirty [illegible]

[illegible]

of the abdomen is always visible even with the surface. Thus respiration is carried on, I suppose. The sensation is a dull itching; and if the person is much occupied the entrance is very likely to be effected unperceived; at least, it was often so in my own case. Then a day or two may, perhaps, elapse before any considerable annoyance is felt. This consists of a tenderness about where the insect is, with an itching there or thereabouts. The nigua may be in the great toe, and you will rub or scratch the second or the third; or it may be in the bottom of the toe and the itching be felt at the root of the nail. This is one of the peculiarities of the irritation caused by this almost invisible pest. Another peculiar effect of the puncture, or lodgment, of the nigua is, that, after it is completely extracted the irritation continues the same for a day or two thereafter, especially if the part be scratched or rubbed. If now it be neglected very likely it may not be felt again till after several days, and when it has become nearly or quite gravid, when a slight soreness or a tenderness is sure to be experienced.

It is exceedingly rare that any ill-effect results from the extraction of a single nigua, or of a few, unless the party should be peculiarly predisposed to disease. The reason why the negroes are so much troubled by them is their own neglect, stupidity, laziness, or the toughness of the skin, or all combined. Their feet frequently are in a most disgusting condition, and the extirpation of the animals is not unattended with danger of ulceration, sometimes resulting in lockjaw.—CHARLES WRIGHT.

BIRDS' EGGS.—I will give a few hints taken from Mr. Wheelright and others. The utmost importance is to be placed upon the proper identification of the specimens. To every bird's leg attach a label noting sex (♀ for female, ♂ for male), date of capture and locality. Blow the eggs with a blow-pipe. Make but one hole and that on the side. Above the hole write the initials of the collector, and under it the number. (It is well also to put Baird's Smithsonian number on each). All the eggs in one nest should have the same number.

Suppose I take my first nest, Canada Jay, 15th March, with three eggs, I mark all three eggs, say No. 5, and keep a small note-book ruled thus:

Date.	Name.	No. on Eggs.	Remarks.
March 15.	Canada Jay, 3 eggs.	5	Taken by myself (or as the case may be) out of a small spruce, six feet from the ground. Old bird shot. (Describe the nest, and any and all particulars.)
April 30.	Gos-hawk, 3 eggs.	6	Taken, etc.

A printed label, with the name of the bird, looks very neatly. In the case of small birds always preserve the nests, as they are often more interesting and valuable than the eggs themselves. All the eggs of the same nest, and the nest, being numbered the same, by a reference to the little note-book the identification of any eggs (even if they get mixed) is very easy, and the history of any specimen can be ascertained. If an egg has

been sat on very long this will be found a good process to clean out the embryo: Make a little larger hole than usual in the side, pick out as much of the young bird as you safely can, and then blow water into the egg with a blow-pipe; let it stand for some days in a dark drawer or box; keep repeating this process about every third day, gradually blowing more water into the shell, and picking a little out, till the whole of the embryo has decayed and is removed. This is a safe and sure way for a rare and valuable egg. I often put large eggs where the Cabinet bug (*Dermestes*) can get into them, and clean out any foreign matter adhering to the shell. — G. A. BOARDMAN.

HABITS OF EARTHWORMS.* — Last spring and this I was led to watch the common earthworms in my garden, and on the plot of grass saw their manner of feeding. I was within ten inches of their holes. I saw one prepare to feed on a young clover leaf from a clover stock; he kept his tail secured to the hole (as a base line) in the ground, by which he retreated quicker than the eye could follow him. Finding all quiet he came again. Within a few inches of my eye the pointed head of the worm changed, and the end was as if cut off square. I then saw it was a mouth. He approached the leaf, and by a strong and rapid [illegible] action of the rings of the whole body drew the leaf and one inch of the tender stock into his mouth, and then by a violent muscular action drew the whole stock of young and tender clover towards him, and when all the substance was sucked out he let the plant go and it [illegible] back to its former place. The leaf and stem were [illegible] as though it had been [illegible]. I then had a small [illegible] down and [illegible] to feast both on the [illegible] after [illegible] powers of suction [illegible] as well as [illegible] been [illegible] the clover leaf. I also [illegible] when the [illegible] female are together they appear as one [illegible] KNIGHT [illegible]

HONEY BEE KILLED BY ASCLEPIAS [illegible] — I found [illegible] in M[illegible] N[illegible] in the summer of [illegible]

[illegible]

stalk then catches in the groove of the gland, and draws out a new set of pollinia. Passing to a new flower (or another part of the same perhaps) the same process is renewed, and I have found strings of the glands and shafts thus attached to each other, particularly on the old flowers of *A. incarnata*. On one occasion I caught an insect, on *A. incarnata* I believe, which had drawn out the pollen of this species by means of the shaft of *A. purpurescens*. At that time I had not a set of the various pollinia to compare the two with, and I sent the specimen to that enthusiastic botanist, W. W. Denslow, who had made a set, and he verified my supposition. This incident would show that the same insect had within a short time visited more than one species of *Asclepias*. Do insects visit flowers promiscuously, or do they, as one guest, confine themselves to one species? I have watched honey bees on a bed of hyacinths and thought that the same set confined themselves to the same color. Is there any rule in the matter? My lamented friend, W. W. Denslow, was engaged with me in working up the subject of the fertilization of Asclepiads by insects, when death cut short his studies. I had urged him to write to you on the subject but he had points which he wished first to settle, particularly how the hair of the insect is held in the gland of the stigma.—W. H. Leggett, *New York*.

Another Double Egg.—A short time since I visited a family, the lady of which had broken a number of eggs to fry for breakfast a few moments before I had arrived, and in the inside of one of the eggs was a small, perfectly formed egg, about the size of a pigeon's egg, which was given to me, and which I now have. I removed the contents, consisting of albumen alone. The egg from which it was taken contained the usual contents, white and yolk.—R. L. Walker, M. D., *Penn*.

Six cases of double eggs are noticed on page 50 (Vol. ii) of the Naturalist.—Eds.

The Kingfisher in Winter.—I noticed this day (December 11, 1868), about noon, a kingfisher perched on a tree, making his usual wild notes, and looking for his game; below him was a small stream, a spring which does not freeze over in the coldest weather and in which fish can be seen. The day mentioned was very cold, 20° below zero. I had supposed that those birds went to the South long before this. Can they endure our Northern cold weather? Where do they keep themselves in our very cold nights?—Henry Davis, *Houston County, Minn*.

A few kingfishers remain all winter in New England.—Eds.

Externally and Internally Parasitic Acari.—M. Guérin Méneville notes, in a letter to the French Academy, the sudden appearance of innumerable acari (*Tyroglyphus feculæ*) on his potatoes. In less than eight days these little arachnidans became so abundant as entirely to cover the potatoes, and form a seething mass. He is at a loss to account for their remarkable and sudden appearance.

Mr. Charles Robertson, Demonstrator of Anatomy in the University of Oxford, has lately described a form of acarus found inside pigeons, chiefly

amongst the connective tissue of the skin, the large veins near the heart, and on the surface of the pericardium. In some respects the acarus described agrees with *Sarcoptes*, but has an extraordinary maggot-like appearance. The discovery of an external parasite inside an animal, in such numbers as Mr. Robertson records, is very remarkable. Colonel Montague found such acari in the gannet, and Mr. Robertson has since found them in the pelican. It is exceedingly difficult to account for their appearance. Are they undergoing a normal phase of their existence, or have they been accidentally introduced in the cases recorded, and found the habitat a favorable one?—*Quarterly Journal of Science, London.*

ORNITHOLOGICAL.—In the September (1868) NATURALIST Mr. Kedzie gives an instance of the "breeding peculiarities" of the Golden-winged Woodpecker (*Colaptes auratus*), in which he states that he obtained thirty-three eggs from one of their nests, and calls upon any of the readers of the NATURALIST to surpass it.

In the spring of 1865, while in Maryland, I obtained twenty-two eggs from the nest of our common House Wren (*Troglodytes ædon*), and doubtless would have got more had not the nest been broken up. Mr. George Hensel, taxidermist of this city, also informs me that he once obtained twenty-eight eggs from the nest of a Kingbird (*Tyrannus Carolinensis*). Although the number of eggs obtained in the two cases mentioned are not equal to those got by Mr. Kedzie, yet considering the size of the different birds I think that I am a little ahead of him.

Last spring, while in Florida, I found the Bluebird (*Sialia Sialis*) breeding there. Can any of our ornithologists inform me whether it has ever been found breeding so far South before?—C. H. NAUMAN, *Lancaster, Pa.*

REGENERATION OF LIMBS.—M. Milne-Edwards has communicated to the French Academy some new results of M. Philippeaux's experiments on the subject of the regeneration of limbs. The author's early experiments made on reptiles prove that if the limbs of a newt be cut off, the scapula or ilium being left behind, the limbs will be reproduced, but that if the scapula is removed the limb is never reproduced. He has now been experimenting on fishes, and has proved that this is true. If the fin-rays of a fish be cut off they will be reproduced; but if the part which is homologous with the scapula be removed, no reproduction will take place.—*Scientific Opinion.*

THE MARYLAND MARMOT (*Arctomys monax* Gmel.), more popularly known in this locality by the common name of "Groundhog," is still tolerably abundant in the southern districts of Lancaster County, Pa.; but I never knew they were so prolific, at least I have seen nothing on record that indicates anything like the fecundity of a female specimen captured in Drumore Township, on the 24th of April last. This subject, before she was killed, brought forth five naked cubs, and afterwards our taxidermist found that her matrix contained six more, making eleven. These young were all entirely nude—not a particle of hair on any of them—and a sort of film over their eyes. They may have been prema-

turely brought forth through the excitement incidental to capture, as these animals are usually very shy, going abroad mainly during the night. A curious fact in reference to these young marmots is, that one of them was immersed in cold water for two hours without destroying life. They were fully three inches in length, and I should judge from their size, weighed about an ounce and a half. — S. S. Rathvon, *Lancaster, Pa.*

The Salt Lake Ephydra. — In the April number of "Hardwicke's Science-Gossip," is figured an "animal from Salt Lake," which the correspondent and editor seem unable to identify. It is undoubtedly the larva of Ephydra, of which the fly and puparium have been figured in the Naturalist, Vol. II, p. 278, and a short account given of the occurrence of other species in the salt-works in Germany, the Equality salt-works, Gallatin County, Illinois, the salt Lake Mono, California, and the coast of Labrador and Massachusetts, where it lives in salt or brackish water. — A. S. P.

The Spider and Mud-wasp. — Mr. Thomas Affleck, of Ingleside, Mississippi, in a letter to the late Dr. T. W. Harris, dated July 20th, 1848, and preserved in the Library of the Boston Society of Natural History, relates the following curious incident: — I noticed a singular incident the other day, confirming a strange fact (to me) in the insect world. A very large spider was attacked by one of the small blue mud-wasps, or dirt-daubers, not half its size, and on the ground. The spider seemed much alarmed, and managed to fend off his antagonist and escaped at a rapid pace, doubling and winding. The wasp seemed to have lost him for several seconds, but presently it circled round like a well-trained fox-hound, and on striking the trail ran it closely through all the doublings and windings of the spider, overtaking and attacking him again. This was repeated two or three times, the wasp clearly trailing the spider, as a hound would a fox. At length he succeeded in stopping the spider, when a capital fight ensued, lasting at least a minute. The spider had no chance with his enemy, who soon stung him to death, losing a leg only during the fight. After resting a few moments the wasp circled around again, evidently selecting a smooth path, along which he dragged with much difficulty his bulky prey. The moment he met with an impediment, dropping the spider, he circled round again, and invariably chose a smooth path. Where did instinct cease, and reason begin here? Were you aware that insects followed a trail, from the scent, in this way?

Variation of Bluebirds' Eggs. — I found on the 17th of May a nest of eggs so peculiar that I wish you to know of them. I was hunting east of here when I saw a bluebird enter a small hole in an old stump. I noted her carefully, and also recognized a male near by. When I found my hand would not enter, and that the bird would not come out, I pushed the stump over, tearing away a part, and not till then did the bird come out. I am *certain* that it was a female bluebird, but every one of the five eggs was *pure white*. I also noticed that, unlike the woodpecker's, the bottom of the cavity was well bedded with grass; strictly a bluebird's

nest. The eggs were nearly ready to hatch, and I could not save but four, poor specimens. I examined the embryos, however, carefully, and they had the bill and feet of a *Sialia*. It is a variation entirely new to me, although I have seen hundreds of bluebirds' eggs. I have no doubt whatever of its identity.

I also have another egg in my collection which is a nondescript. It is $1\frac{1}{12}$ inches long, of a very light bluish-green, sprinkled all over with grains of light brown and many other obscure specks; globular. It was in a crow-blackbird's nest, which had besides its full complement of eggs, in a small swamp near Munroe, Michigan. That was in 1867, and though I have searched many blackbirds' nests since I have seen nothing like it, nor can I find any one who has ever seen such. There was but the one. I am confident that it is a parasitic egg, though *manifestly* not a cow-bunting's. — Ernest Ingersoll, *Oberlin, Ohio.*

GEOLOGY.

New Species of Fossil Horse in Mexico. — Prof. R. Owen has described the teeth belonging to an extinct horse, found in the newer tertiary deposits of the valley of Mexico. "It is unlikely, seeing the avidity with which the Indians of the Pampas have seized and subjugated the stray descendants of the European horses, introduced by the Spanish 'conquistadors' of South America, and the able use the nomad natives make of the multitudinous progeny of those war horses at the present day, that any such tamable equine should have been killed off [illegible] [illegible] of the South American aborigines [illegible] [illegible] the fossil contemporaries of this horse [illegible] [illegible] the *Equus Tau* Owen from the same locality [illegible] *E.* [illegible] and also the Megatherium, Mylodon, [illegible] [illegible] Glyptodon, and Mastodon, were rendered [illegible] [illegible]

ANSWERS TO CORRESPONDENTS.

[illegible] The galls from the [illegible] are probably those of [illegible] [illegible] each [illegible] parasite.

ERRATA.

[illegible] Page 2[illegible] line 25 from [illegible] [illegible] November [illegible] [illegible] Page 21[illegible] line 25 [illegible] for *Fjell*, read *Hell*. Page 221 line 6 from above, for [illegible] read *carefully*.

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THE RED-TAILED HAWK.

BY DR. W. WOOD.

THIS bird is generally known as the Hen-hawk (*Buteo borealis*). It is so seldom taken in this vicinity that when captured the hunters will tell you that they have killed "one of the real old-fashioned hen-hawks."

Having recently had the young of the Red-tailed Hawk brought to me as something new and rare, and as there is such a dissimilarity between the adult and the young that no one except a naturalist would recognize them as the same bird, I will give a description of the bird in its different plumage, with an account of its habits.

On the Pacific the Red-tailed Hawk is supplanted by a closely allied species (*Buteo montanus*). It is peculiar to America, and in its adult plumage is easily recognized from any of its genus. It is extremely shy, and not easily taken unless approached in a wagon or on horseback. The flight of this bird is strong and firm, often sailing to a great distance without any apparent motion of its wings. Occasionally several of them will be seen very high in the air, sailing about in circles, sometimes rising in spiral turns, and then

descending rapidly, uttering a clear shrill cry of *kae, kae, kae*, several times, and often continuing it some minutes. These gyrations occur more commonly in the spring; perhaps it is a nuptial ceremony, or a bridal pilgrimage. This bird does not always live in that domestic peace and harmony after rearing its young as is proverbially true of birds of prey, often fighting over some game that it would most faithfully toil to procure for its companion and little ones during breeding season. An amusing instance of this kind occurred to my knowledge. One of these birds caught a snake and flew high into the air; its mate followed and tried to force its companion to give up the coveted morsel. For a time I did not know but that they would have to settle it as did the two snakes, each of which had hold of a leg of the same toad, and neither being willing to lose its anticipated dainty repast, the largest snake not only swallowed the toad but also the smaller snake attached to his portion. (Query — Which got the toad?)

In their bill of fare snakes form quite an item in the spring and summer months, but in the winter months the wild game of our woods and the poultry-yard, satisfy the cravings of hunger. It is from the fact of its making such frequent inroads among our domestic fowls that it derives the name of hen-hawk. When capturing snakes they sometimes "wake up the wrong passenger." A farmer living in this vicinity, while putting up a fence around his pasture, noticed a large hawk on the ground some forty rods from him, sometimes rising up two or three feet, then dropping down. Supposing him to be devouring some game he paid but little attention to it at first, but from its continuing in the same place, and keeping up the same manœuvring for a long time, his curiosity was excited, and coming near the bird he discovered that the tail of a large black snake was coiled around the hawk's neck, and that the head and a part of its body was in a hole in the ground; the hawk was nearly exhausted. With a blow of his axe the farmer

severed the snake, and brought the hawk to his barn where he kept him alive for some time. The part of the snake attached to the bird measured three feet, which was, probably, about one-half of its length. The hawk evidently seized the snake when he was partly in his hole and was unable to draw him out, and when found, the serpent was endeavoring to convince the would-be-capturer that "it is a poor rule that don't work both ways." This was the adult Red-tailed Hawk.

In procuring food for their young they frequently act in concert, and if, perchance, they spy a squirrel on a tree one will dive at it while the other poises itself ready to seize it if it dodges to the other side to evade the grasp of the first hawk. From the two there is no escape. Grasping it firmly by the neck the assailant practicably demonstrates the possibility of garroting its victim, when the ill-fated squirrel is carried to the eyry, and torn in pieces to satiate the cravings of their rapacious young. I was informed by one of my collectors that he saw a mink taken in that way by a Red-tailed Hawk, and carried off, although squealing piteously, and vainly endeavoring to extricate himself from the fatal grasp of its cruel talons.

For hours it may be seen sitting in the top of some tree, either sunning itself or watching for game, and woe be to the rabbit, squirrel, bird, or mouse, that attracts his keen eye. In sailing over fields, if it discovers game, it will either grasp it by a side stroke, or check its speed and alight on a tree, if near, where it can watch its motions, when with wings almost closed it will dart upon its prey with unerring aim.

When wounded, like all rapacious birds, it will turn on its back and defend itself with its claws and bill, grasping a stick presented to it so firmly as to be raised from the ground and carried some distance before relinquishing its hold. An instance was related to me illustrating the strength and tenacity of its grasp. A sportsman having

winged one of these birds his dog ran up to it, when his nasal appendage was firmly seized by the enraged bird. Smarting under the chastisement he howled and yelled, shaking his antagonist with force enough, apparently, to dislocate every bone in its body. This was continued sometime before its claws were disengaged, when my informant said "that the dog's nose looked as though it had been *charred*."

They formerly nested here, but I have not been able to find a nest for the last fifteen years. The nest is large and somewhat flat, composed mostly of sticks and twigs, and generally located where it is almost impossible to get at it. According to our writers on oölogy they lay from four to five eggs. This is a larger number than I have found; from two to four has been the usual number. They are dull white, sparsely covered with brown and dark-brown spots. Both birds assist during incubation. Its length is from nineteen to twenty-four inches, and the expanse of the wings from forty-five to fifty inches. The female is considerably larger than the male, as is the case with all our rapacious birds. The head of the adult is large and flat; the tip of the bill much incurved, with the entire upper parts brown, with fulvous edging on the head and neck. The tail is bright rufous, tipped with white, and a little rounded, with the subterminal band of black. The throat is white with longitudinal strips of brown; the under parts are yellowish white with longitudinal brown spots. The under tail-coverts are yellowish white, the legs are yellow, and the iris, [illegible]. In the young the upper parts are lighter brown than in the adult, with more white and fulvous spots; the tail has nine or ten transverse brownish black bands and is tipped with white; the subterminal band is about an inch wide; the under parts are white with large ovate spots of brown and black; the under tail-coverts are spotted with brown. The smaller wing-coverts, from its flexure to the body, are rufous, and similar to the Red-shouldered Hawk, only not as bright rufous.

The only resemblance between the adult and young is in the general form of the head, bill, legs, and claws. It is no wonder that naturalists considered them different species. Nuttall described the young as the American Buzzard (*Falco Buteo*), Pennant as the Great Hen-hawk (*Buteo vulgaris*), and Wilson named it the *Falco Leverianus*. He says, however, "it is with some doubt and hesitation that I introduce the present as a distinct species from the *Buteo borealis*. My reason for inclining to consider this a distinct species is the circumstance of having uniformly found the present (*Falco Leverianus*), two or three inches larger than the former (*B. borealis*).

Ornithologists at that time were not generally aware that the young of many of our birds of prey were longer than the adult. This is very marked in the Goshawk and Bald Eagle. This seeming absurdity is easily explained. After moulting the long feathers never attain their former length. If Wilson had been aware of this fact he never would have introduced the young of the *Buteo borealis* as a distinct species.

RAMBLES IN FLORIDA.

BY R. E. C. STEARNS.

PART III.

FROM Cedar Keys to Egmont Key is eighty-five miles. The latter is situated at the mouth of Tampa Bay, and is forty miles from the town of Tampa; upon it is a lighthouse whose friendly flame shone far across the waters of the Gulf as we steamed along in the early gray of the morning. We had arranged to land at Egmont, wind and wave permitting, as it is good working ground for the naturalist; but a rough sea compelled a change of plan, and we kept on for Tampa.

Tampa Bay is divided at its upper portion, or head, into two smaller bays, one known as Old Tampa Bay, from the town of "Old Tampa," the other as Hillsborough Bay,* which receives a river of the same name. It is upon the southerly bank of the latter that the new or present town of Tampa is located. A very narrow and crooked channel and an insufficient depth of water prevent vessels, excepting very small craft, from reaching the wharves, consequently the steamer was anchored some four miles below the place. Viewed from the deck the scenery is attractive, though the shores, as elsewhere, are quite low. As you face the town, upon the left hand, and half a mile off, is Ballast Point,* an ancient reef; upon the right are islands and the mainland in the distance; in front the military post of Fort Brooke; with its new buildings half-hidden by the sturdy old oaks (*Quercus virens*), whose stalwart limbs are decked with robes of the long Spanish moss, which hang motionless in the quiet air, or flutter like tattered battle-flags when moved by a passing breeze. The post is built upon a sloping lawn whose margin is washed by the waters of the bay; [illegible] of the trees is the parade ground, in the centre of [illegible] symmetrical flag-staff, from the top of which [illegible] the national flag.

There is some little commotion in getting ashore, [illegible] everybody and everything have to be transferred to [illegible] and small vessels; at the time a transient shower was [illegible] ing and the warm rain caused an unpleasant stickiness. [illegible] was soon over however, and we saw our packages [illegible]

* [illegible]

* [illegible]

* [illegible]

safely in a four-ton sloop, and seated ourselves upon the top of the cargo like statues upon a pedestal. The lines were "let go," and after beating in a light wind the sloop was at the wharf by noon.

When a steamer arrives the event is published by a certain number of strokes on the Court House bell; hence the crowd at the wharf. Friends met us as soon as we landed, and with their assistance we found an unoccupied house and an unemployed negro; the former was at once hired for a camp, the latter for a commissary and quartermaster.* In two hours after landing we were "at rights" and housekeeping. Elated with this wonderful dispatch, in the fulness of our joy we thought the millennium not more than "two blocks off," and rashly named our quarters "Camp Delight;" but we had unwisely crowed before we were out of the woods, as will presently be seen.

The population of Tampa is variously stated at from eight hundred to one thousand (people), of all sizes and colors; but this does not include the million (of fleas) that nightly met in mass-meeting at Camp Delight, and compelled us, both in sorrow and in anger, to change the name to Camp Misery. The fleas of California, the black-flies of the Lake Superior swamps, the mosquitoes of the Ohio Valley, all of these we had met on their own ground and never winced, but the fleas of Tampa proved invincible. We thought of the saying of a German poet, "God made the world, but the devil made the flea."

The appearance of the town creates a favorable impression, for it is well planned, the streets being wide and regular and the buildings comely; many of the streets and yards are ornamented with trees; in some of the latter the bananas were just shooting up new leaves to replace those that were cut down at Christmas time by an unusual and severe frost. A large specimen of the American aloe (*Agave Americana*)

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*Soon after our departure from Tampa, our colored quartermaster was elected City Marshal.

standing in the Post Office yard perished from the same cause, though a rosebush near it was loaded with red flowers.* Many of the orange trees were full of fruit, which was ruined by the fatal blast, and bushels were rotting on the ground. In some sheltered spots or warm places on the shore of Old Tampa Bay they were untouched, and we had many a feast upon the golden fruit from that neighborhood. The Florida oranges we consider superior to the Mediterranean, Mexican or Tahitan; they are of large size, good color and fine flavor. The Shaddock (*Citrus decumana*) also grows in the vicinity of Tampa, and very fine specimens of the fruit were purchased by us at the stores. It is extensively cultivated in the West Indies, and many people prefer it to the orange; it is slightly bitter, and the juice, a mild acid, is cooling and healthful. It is called Grape Fruit by the Floridians. Not far from our camp is a grove consisting principally of pines of the species *Pinus palustris*, also called the pitch-pine, and long-leaved pine, and *P. tæda*, known as the loblolly pine, and many may be seen in the streets and elsewhere about the town; they sometimes attain a height of one hundred feet, but we have as yet seen none that exceeded seventy feet. The *Chamærops serrulata*, or Saw Palmetto, here, as everywhere in South Florida, grows luxuriantly in the sandy soil, and just outside of the town it seems to have crowded out all other shrubbery.

Without enumerating the many botanical forms that are met with in this section of the country, a few of the prominent species worthy of mention are the Sweet Bay (*Magnolia glauca* Linn.), which grows to the height of twenty feet, with highly perfumed flowers and shining leaves (an isolated colony of this species sheds its fragrance on the colder air of the north, being found in the vicinity of Gloucester, Mass.); the Southern Buckthorn (*Frangula Caroliniana* Walt.), a species of Hawthorn; the *Catalpa*, or Indian-

*This was in the latter part of January.

bean; also the *Persea Carolinensis*, or Alligator pear,* sometimes called the Red Bay.

The banks of the Hillsborough River at the water's edge are muddy, with a growth of tall coarse grass. The bivalve shell, *Cyrena Carolinensis*,† may here be obtained; also the pretty little river snail, *Neritina reclivata*. From the wharves, at the proper tide, many fish are caught, principally Sheep's-head (*Sargus*) and Mullet (*Mugil*), both of which are good eating. The supply, however, is quite irregular, and the market therefore cannot be depended upon. Oysters (*O. Virginica*) of excellent quality abound in the bay, and can usually be purchased from boats at the wharf. During a portion of the period of our stay at Tampa the market was well supplied with venison (*Cervus Virginianus*) of good quality, thanks to the energy and skill of an one-armed hunter residing a few miles away. The hens of Florida deserve favorable mention, if not a diploma, for their daily dividends were too important to be forgotten.

Stalking along the muddy margin of the stream may frequently be seen the Blue Heron (*Florida cærulea* Baird), and the White Heron (*Herodias egretta* Gray). There is a California species that much resembles this last. The White or Whooping Crane (*Grus Americanus* Ord.) and the great Blue Crane (*Ardea herodias* Linn.), and the Egrets (*Demigretti Pealii* Baird) with white plumage, and another (*D. rufa* Baird) of a reddish color, are found in this part of the state around the shores of the bay and gulf. Many others of the long or stilt-legged bipeds, of the feathered tribes belonging to the Grallatores, or waders, are met with when rambling through the marshes or exploring the bends, inlets or sloughs of the river, or are seen by us from the boat while

*We were unable to obtain any of the fruit at the time of our visit in the winter; it was quite likely out of season. A species grows in Mexico, but whether identical with the Floridian we do not know. The Mexican fruit is nearly round, of the size of an orange; it has a bright green skin or rind, and contains a pulp of a peculiar flavor which melts in the mouth like butter. It is eaten with pepper and salt.

†Valves of this shell were found by us in the shell-heaps, but are not common.

rowing up or down the stream. With a scoopnet rigged with a long pole, an important and at many times an indispensable implement for the collector, we dipped up from the bed of the stream a small white bivalve shell (*Tellina*), and a single dead specimen of the fresh-water Mussel, *Unio** *Jewettii* Lea. The Floridian Unios have much lighter shells than most of the species found in the tributaries of the Ohio and Mississippi Rivers.† The once famous British pearls were obtained from a species of Unio (*U. margaritiferus*) found in the mountain streams of Great Britain, and the fishery was continued till the end of the last century in Scotland, where the mussels (Unios) were obtained in the River Tay by the peasantry previous to harvest time. The British pearl fishery has long ceased to be remunerative.

The fresh-water mussels must be exceedingly scarce in this vicinity, and in fact for many miles on the western side of Florida, for we found none living nor a fragment in any of the mounds and shell-heaps that we examined. The Portuguese and Spanish narrators of the expedition of De Soto have given absurd accounts of the quantities of pearls in the possession of the natives. It is highly probable that the Indians inhabiting Georgia and Alabama, at the time of and prior to the invasion of De Soto, lived in part upon the animals of the various species of Unio found in the rivers of those states;‡ for "heaps of mussel shells are to be seen on our river banks wherever Indians used to live."§

It may be that the Indians referred to collected the shells solely for the purpose of procuring the pearls; yet the proportion of shells containing pearls is so small that when, as mentioned in the text, "the Portuguese narrator says they

* [illegible]

† [illegible]

‡ [illegible]

§ See Note to Irving's Conquest of Florida. Ed. [illegible], p. [illegible]

obtained fourteen bushels of pearls"* from a certain sepulchre, and as can be found at another place in the text that a common foot soldier, whose name is given as Juan Terron, had "a linen bag in which were six pounds of pearls;"† and elsewhere, that everybody, Spanish and Indian had pearls, and "as large as filberts;"‡ either the sources from whence the old historians derived their information were unreliable, or the Unios which are probably as abundant in the rivers as heretofore, have, to a very great extent, ceased to manufacture these much valued concretions. The latter case is hardly supposable. Perhaps one shell in a hundred might yield a pearl, of which not one in a hundred would be either clear or of perfect form, and not one in many thousands would be as large as a filbert.§

Between Camp Misery and the river, in wet or springy places upon the under side of pieces of boards or chips, many snails (*Helix volvoxis* Pareyss) can be collected, and the Coffee-shell (*Melampus caffea*) is close at hand. It is also found in the West Indies. Just outside of the fence that encloses the reservation of Fort Brooke, to the south, is a good place for obtaining *Glandina truncata*, a species of snail with a shell of a pink color, sometimes three inches long. It looks much like one that is found in Nicaragua (*G. rosea*). The Glandinas are carnivorous, and our Floridian is a cannibal, and eats without either hesitation or remorse the smaller snail, *Helix volvoxis*. The eggs of Glandina are of a whitish color, and about the size of a very small pea; it lives in moist grassy places, and a few boards that were on the ground at the locality referred to made an excellent trap; the Glandinas prefer the shade, and in order to protect themselves from the heat of the sun, hid themselves under the boards, which we frequently turned over,

* Irving's Conquest of Florida. Ed. 1869, p. 230. † Id., p. 239. ‡ Id., p. 245.

§ "An account of the Irish pearl-fishery was given by Sir. R. Redding, in the "Philadelphia Transcript," 1693. The mussels were found set up in the sand of the river-beds with their open side turned from the torrent. About one in a hundred might contain a pearl, and one pearl in a hundred might be tolerably clear." (Woodward's Recent and Fossil Shells, p. 434.)

always capturing some. Upon one occasion, in addition to several Glandinas, two specimens of a beautiful lizard rewarded our search.

We had heard at sundry times marvellous stories of numberless snakes of divers species, and of assorted sizes, that lay in wait to swallow, crush or poison unsophisticated strangers. These fearful tales led us to keep a sharp lookout when on the tramp. Either the snakes snuffed danger from afar and "hunted their holes," or else they are scarce, as we failed to secure a specimen, though two or three were seen. We concluded that our informants had in some way deceived their eyes by using the fusil oil which hereabouts is sold for whiskey, one dram of which would cause the drinker to see not only snakes but an entire menagerie. From the time when the serpent made mischief for the human race through the beguilement of its original mother, down to the present day, the snake family have had a bad reputation, and stories illustrating their wickedness, however preposterous, are readily believed.

Near the town, and in the immediate vicinity of the spot where Glandinas "most do congregate," stands an ancient mound, in shape a flattened hemisphere, with the plane side down. Its position is such as to furnish a delightful out-look upon the bay and a fine view of the surrounding scenery. It is not of large size, being only one hundred and sixty paces in circumference and fifteen feet high; it was formerly more nearly semicircular in perpendicular outline, as the rains of centuries have washed it off at the summit, thus reducing the elevation, and consequently increasing the circumference of the base.

The mound was covered with grass, and many stately trees are near it whose graceful proportions form, by contrast with the general flatness of the ground, a conspicuous and charming feature in the landscape. From the investigations made by our party it was undoubtedly devoted to burial purposes, and but few shells were used in its con-

struction. Six species of the common marine shells of the neighborhood were collected; also stone implements, and pieces of crumbling bones,—portions of the skeletons of men. This mound* may have been the "artificial eminence near the shore," upon which stood the dwelling of the cacique, Hirrihigua, who bravely opposed the adventurous but cruel Pamphilo de Narvæz in his expedition to Florida, in the year 1528; and the meagre remnants of a human form whose sepulchre we had rudely violated, may have belonged to the outraged and vindictive chief, who, stung by the remembrance of his wrongs, replied to the overtures of De Soto with words of scorn.†

THE SYLVA OF MONTANA.

BY J. G. COOPER, M. D.

The following notes comprise an enumeration of the trees of the Rocky Mountains, etc., from Fort Benton, Nebraska, to Fort Colville and Fort Dalles, Oregon, with remarks on their distribution.

SMOOTH SUMAC (*Rhus glabra?*). No species extends along the Upper Missouri above Fort Union, and I am therefore inclined to think that the species of the Columbia Plain, which extends north to Fort Colville, is distinct though nearly allied to this. In Walla Walla valley it becomes fifteen feet high, and may attain, farther south, to the size of a small tree. It grows also in the Yakima valley, and west to Fort Dalles, Oregon.

ASH-LEAVED MAPLE (*Negundo aceroides*). The Box Elder reaches the Rocky Mountains at Fort Benton, but does not cross them there, no species reaching the Columbia

* Vide Irving's Conquest of Florida. Ed. 1869, pp. 28, 58, 59.

† Hirrihigua said, "I want none of their speeches nor promises; bring me their heads, and I will receive them joyfully." Id., p. 60.

river, though the climate is so much milder than that of the Upper Missouri. This is an additional reason for considering the western species (of California, etc.) distinct from the eastern, though that of Utah and Western Texas may very probably be the latter. The *Rhus* shows a distribution the reverse of this, as compared with the eastern *R. glabra*.

SMOOTH MAPLE (*Acer glabrum*). This commences to appear at the eastern base of the Rocky Mountains, and grows entirely across to Fort Colville and the east slope of the Cascade Range, becoming forty feet high and a foot in diameter. *A. tripartitum* Nutt., is merely a young or dwarfed form of it in dry soil.

CHOKE-CHERRY (*Cerasus Virginiana?*).* A tree, apparently this species, grows all the way across the mountains, extending to the Bitterroot Range, and growing thirty feet high and six inches in diameter. A small cherry tree, or rather a shrub, grows about the borders of the Columbia Plain, apparently the same in leaf, but I think the fruit is larger. I have never seen the flowers.

CHERRY (*Cerasus mollis?*). I found a shrub at the Cœur d'Alêne Mission and westward, which I took for this from the leaves. It is stunted in that latitude.

WESTERN MOUNTAIN-ASH (*Pyrus fraxinifolia? vel Americana?*). The Mountain-ash of the western mountains, scarcely distinct from that of the north-east, first appeared on the east slope of the Cœur d'Alêne Range, and extends in small numbers to Fort Colville, scarcely deserving to be called a tree anywhere. I did not find it with fruit on the route.

RIVER HAWTHORN (*Cratægus rivularis*). A hawthorn, with black berries, and otherwise the same every way, extends from the east base of the Rocky Mountains, west to the Cascade Range ("Willamette River," Nutt.), forming a shrubby tree fifteen to twenty feet high. It is finest along the Spokan River.

* See Torrey and Gray's Flora of Nebraska.

RED HAWTHORN (*C. sanguinea?*). The red-berried Haw grows sparingly from Walla Walla to Fort Colville, but is so similar in leaf to the preceding that it may perhaps be only a variety. Specimens of both collected in fruit give an opportunity of trying the distinctions of the seedling plants.

OREGON BEARWOOD (*Frangula Purshiana*). This species of Buckthorn occurs on both slopes of the Cœur d'Aleño Mountains, but not farther east. With it occurs a low bushy species of *Rhamesus*, as shown by fruiting specimens of each collected together.

OREGON SERVICE-BERRY (*Amelanchier alnifolia*). I must consider this distinct from *A. Canadensis* of the east, because it preserves its peculiarities of leaf, growth and fruit, from the eastern base of the Rocky Mountains to the Pacific coast, through much variety of climate and soil, differing only in height in the drier localities. It attains its greatest luxuriance and excellence of fruit in the valley of the Hell Gate river, where our whole command feasted on the berries for several days.

GREEN DOGWOOD (*Cornus pubescens*). It was first seen near the crossing of Bitterroot river, and extends at intervals to the west coast.

WESTERN SUGAR-BERRY (*Celtis reticulata*). This tree is strictly limited toward the north-west by Snake and Columbia river, as observed in 1853. It is scarce along them and grows only about thirty feet high, with a short trunk sometimes a foot thick.

OREGON OAK (*Quercus Garryana*). This oak does not grow east of the eastern base of the Cascade Range, or north of the Yakima river, on this side. No oak occurs from the Columbus river to Fort Union, on the Missouri, near which place is found *Q. macrocarpa*. No ash grows in a similar interval, though one extends to Milk river on the Missouri.

OREGON ASH (*Fraxinus Oregona*). This first appears at the Dalles.

WESTERN POGUE-BIRCH (*Betula occidentalis*). This birch forms a shrubby tree, from Sun river through the Rocky Mountains to the Cœur d'Alene river, where it becomes of large size, sometimes two feet in diameter and sixty feet in height, of handsome appearance, and with a laminated bark of which the Indians make canoes. The color of the bark is of a pale coppery yellow, dark on the branches, and the leaf is always quite small. It is common at Fort Colville, where I took it for *B. papyrifera*, when leafless, in 1853, and the dwarfed form, growing along streams of the Great Plain to the Cascade Mountains, is the *B. resinosa* of my report. I saw it at Fort Walla Walla, but not at Fort Dalles.

GREEN ALDER (*Alnus viridis?* or new species (perhaps *rubra* of Bengard Veg. Sitch.). This alder has a range similar to that of the western birch, and attains a similar size toward the west. Its bark is less white and its leaves finer toothed than those of *A. Oregona* near the coast, which I first saw at Fort Dalles.

WILLOWS (*Salix*). The willows were only to be [illegible] leaf, and if determinable, will probably prove to be *S. [illegible]leriana*, *Hookeriana*, and *longifolia*, but I cannot give accounts of their respective distribution, as these trees [illegible] long acquaintance to distinguish them by the leaves only

NARROW-LEAVED POPLAR (*Populus angustifolia*). [illegible] peculiarly western poplar does not extend east of the [illegible] of the Rocky Mountains at Forts Benton and Laramie. It varies much in the leaf, even on the same tree, some [illegible] four inches wide; and though I believe it to be the [illegible] common species in the mountains, I was often in [illegible] whether this or *P. balsamifera* was the most so, as I [illegible] not always distinguish between them at a little distance.

BALSAM POPLAR (*P. balsamifera*). This seems to be the prevailing species of "Cotton Wood" along the Missouri above Fort Union, and across the Rocky Mountains, [illegible] is not uncommon to the west coast. The tree seems dis-

tinguishable when leafless by its yellow twigs. I doubt whether *P. monilifera* grows so far north in the mountains.

ASPEN (*P. tremuloides*). The aspen occurs at intervals throughout the mountains, usually about gravelly ponds, but is not common.

TWISTED PINE (*Pinus contorta*). I first met with this pine at the east base of Mullan's Pass, where a single tree of unusual size seemed to me at first distinct from this species. It was two feet in diameter, and fully sixty in height, the branches crowded with cones of all ages, but west of the pass I found the more usual form abundant, which indicated this to be only a luxuriant specimen. It is the most prevalent tree of the higher Rocky Mountains, as far down the west slope as Deer Lodge prairie. It then becomes rare in the valley until reaching the crossing of the Bitterroot, when it again becomes abundant, forming groves by itself on poor sandy or gravelly soil exactly as on the coast. Towards the rainy summit of the Cœur d'Aleñe Mountains, however, it is scarcer, being the seventh in abundance of the trees; it is still rarer on the west slope, but at the Mission rather common, though not observed much farther west. Its growth seems like that of most other trees more dependent on a certain degree of moisture than on temperature.

PITCH PINE (*P. rigida*). This eastern species is common on the eastern spurs of the Rocky Mountains, in the upper "Bad Lands" of the Missouri, from Milk to Judith river, and on the "Black Hills" near Fort Laramie, but I did not find it west of the Rocky Mountains or of Fort Benton.

YELLOW PINE (*Pinus ponderosa*). The Yellow Pine is the prevailing species in most parts of the Rocky Mountains traversed, though much less common than others in the Cœur d'Aleñe Range. It presents the same appearance from the east base of the Rocky to that of the Cascade Mountains, being unmistakable as far as it can be seen. On the Hell Gate I saw the largest, some fully four feet in diameter, and it grows in the driest sandy soil, where no other

tree can exist. *P. Banksiana* and *P. resinosa* have been reported to grow along the Spokan river, but I am sure none occurred at parts I have visited, and think this and the preceding have been mistaken for them.

WESTERN WHITE PINE (*Pinus monticola*). I found scattered trees of this beautiful species on the highest parts of the Rocky Mountains, but from the east base of the Cœur d'Aleñe Range to its summit it rapidly became one of the most abundant and luxuriant trees, again disappearing gradually, but faster, as we descended their west slope. It attains a diameter of four feet, and a height, probably, near one hundred and fifty, resembling the eastern White Pine (*P. strobus*) in habit, but with finer grooved bark (like that of *Carya tomentosa*, Mockernut), more slender and shorter leaves, and much larger cones. The wood is very fine-grained and soft. The specimens, from stunted trees in the Bad Lands at Little Rocky Mountain creek of the Missouri, are so different as to seem distinct in species, or at least a very marked variety, probably the latter.

BLACK SPRUCE (*Abies Menziesii*). This Black Spruce is as abundant on the higher parts of the Cœur d'Aleñe as on the coast, and presents exactly the appearance described in my former report. It is perhaps less in size, but has the same drooping, dense twigs and foliage that give so sombre an appearance to the coast forests. I saw it nowhere else on the route.

OREGON YELLOW FIR (*A. grandis* and *amabilis*). From many specimens of cones and leaves, together with observations on the trees, I am strongly inclined to consider these the same species, not varying more than several others. The lower white and smooth-barked form, with dense growth and foliage, appeared moderately common on the east slope of the Cœur d'Aleñe Mountains, and across the summit. On the west slope it gradually became taller, more open in its branches and foliage, the cone larger and with broader scales, the bark grooved more and more, and darker in

shade until in the rich moist bottom-land the tree is one hundred and fifty feet high and over four feet in diameter. This is the true *A. grandis*, and the same as grows along the Lower Columbia, while a middle form occurs sparingly about Puget's Sound, and was referred to by me in a former report as possibly being the true *A. taxifolia*, for which see the notes on *Abies Douglassii*. The dense growing, white-barked variety (*amabilis*), attains three feet in diameter, and one hundred feet in height, on the east slope of the above-named mountains.

DOUGLASS, OR RED FIR (*Abies Douglassii*). This spruce exhibits nearly as much adaptability to all circumstances as *Pinus ponderosa*, which it accompanies throughout the Rocky Mountains, but is much less abundant in the drier situations than that, and more so on the moist Cœur d'Aleñe Range. It varies in the color of the bark, length of cones, leaves, etc., as might be expected in so many localities.* The young shaded tree, growing in the moistest spots, has leaves an inch and a half long, shining, and the bark smooth and white, so that only the single arrangement and more lax growth distinguish it from young trees of *A. grandis*. This is doubtless the true *A. taxifolia*, as before suspected, and loses its distinctness of character with age. This form, with very long slender leaves and cones, prevails mostly on the west slope of the Cœur d'Aleñe, Cascade and Coast ranges, where there is most rain. The largest Rocky Mountain trees do not quite equal some of those on the Lower Columbia. It is the only spruce I saw from Fort Colville to the Spokan river, where its range is stopped by the Great Columbia Plain. It reappears at the Dalles, and probably also on the Blue Mountains.

After observing these coniferæ, and other trees also, for some time, the eye learns their general habit so well, that there is usually no difficulty in distinguishing species at sight, and at a considerable distance off.

* It grows on the first mountain range, nearly as far east as Milk river, to longitude 107°.

WILLIAMSON'S SPRUCE (*Abies Williamsoni*). This fine spruce is abundant on the summits *only* of the Cœur d'Alêne Mountains, where it grows three feet in diameter, and one hundred feet in height, with a ragged gray bark much like that of the eastern Sassafras. The general habit is like that of the Hemlock Spruce, but rather stiffer, and the foliage is denser, forming several imperfect rows on the twigs. The cones are two and a half inches long, pendant from the highest branches only. None of them contained ripe seed at the time of my visit. The wood appears much like that of the Hemlock Spruce. The closeness of its limitation to the dividing ridge is remarkable, since, although found at the base of this ridge, it there grows only from three to six feet high, and produces no cones. I took these at first for some species of Juniper. Newberry's figure represents it as being too rigid, like *A. Douglassii*. It is far more feathery.

MERTEN'S SPRUCE (*A. Mertensiana**). I have long considered this distinct from *A. Canadensis*, though the difference, if any, is only in its larger growth, and perhaps in the glands of the seed, which I have not compared with those of the eastern tree. There is however a wide interval in their range, *A. Canadensis* not growing north or west of Lake Superior. I first met with this on the west slope of the Cœur d'Alene Mountains, only a few dwarf [illegible] specimens growing on the east side, and none on the summit. It ceases west and north of the Lake on the route I followed.

WESTERN LARCH (*Larix occidentalis*). I found this fine Larch first near Bitterroot valley, whence it becomes rather common throughout the route to Fort Colville, holding a middle place in relation to the moisture and temperature of the various portions. It is about equal to *Pinus ponderosa* in size, but has very short branches, as they break off from the brittleness of the wood as it grows high. The bark is

* *A. Bridgesii* Kellogg. Proc. Cal. Acad., 1858-'59.

reddish like that of the pine, but only an inch or two thick instead of four or five, and of course less deeply furrowed. The pale, elegant foliage, is easily distinguishable where it forms groves on the mountain slopes, but it is more scattered in its distribution than most coniferæ, never, as with the eastern *L. Americana*, growing in swamps.

WESTERN ARBOR-VITÆ (*Thuya gigantea*). Scarce along the lower part of the Bitterroot, this enormous tree becomes fully developed only on the west slope of the Cœur d'Aleñe Range, where a cedar swamp occurs, the trees, perhaps, even larger than near the coast. They range from six to eight feet thick, and a dozen of these giants often grow in a space of five or six rods square, so that Lieut. Mullan's party could not find room to pass between them, and had to cut down some, the road going over the stumps! Nothing compares with this in tree growth except perhaps the *Taxodium* swamps of the Gulf States, and here the cedars seem to have grown from sand and water only!

RED CEDAR (*Juniperus Virginiana*). This grows large and abundant along the Upper Missouri, and more scattered, though still a tree, entirely across the Rocky Mountains, following the rivers around the Cœur d'Alene Range to Fort Colville, and south to the Spokan river at least. I was told that a large grove of it (or possibly *occidentalis*) grew on the north-west border of the Great Plain of the Columbia, but could not determine which those are which grew near Fort Dalles. I was very much puzzled to determine whether this or *J. communis* was the species sometimes seen on the Upper Missouri, of a tree form, but with large berries. It may be a hybrid, or perhaps *J. occidentalis*, with which it agrees in the colorless wood. *J. communis*, in its low prostrate forms, is very common along the Upper Missouri, but I did not see it farther west, and the dwarf form of the Cascade Mountains, found in 1853, *may* belong to *J. occidentalis*, though Dr. Newberry found farther south on these mountains what he considers *J. communis*.

OREGON YEW (*Taxus brevifolia*). The Yew, first met with on the east slope of the Cœur d'Alene Mountains was there low and prostrate like *T. Canadensis*, but became larger on the west side, attaining two feet in diameter and sixty feet in height, exactly resembling that of the coast. It does not pass Lake Cœur d'Aleñe. The elevation of the east slope of these mountains is much greater than of the west, which accounts for the dwarfing of this, as well as of *Abies Mertensiana* and *A. grandis*.

DISTRIBUTION OF THE FORESTS, ETC., WITH FACTS RELATING TO PHYSICAL GEOGRAPHY.

The configuration of the country traversed, as well as its productions, climate, etc., naturally divide it into four sections, which have limits closely connected with those of the geological formations. A closer exploration would perhaps also separate these into a larger number, but I propose now to speak of them chiefly in connection with the distribution of the forests, which everywhere indicates to a great extent that of the smaller plants and animals also.

*Hesperian Region.** — From the Rocky Mountain summit, east to Milk river, the country, although the prairie [illegible] predominates, is crossed by the easterly ranges of the [illegible] Cordillera, upon which are found several trees [illegible] western, with some eastern species commingled. [illegible] low where the Missouri breaks through, the mountains rise to a great height in the distance, and are said to be well wooded on many portions. Of this we had evidence in the large quantity of coniferous timber covering the rocky [illegible] and bluffs, from above Milk river nearly to the Judith.* Its growth was limited only by the prevalence of fires wherever

* [illegible] the [illegible] Report [illegible] the [illegible] that here given [illegible] appropriate than the sentimental [illegible] referred to.

* [illegible] the river, [illegible] Mussel Shell near [illegible] the [illegible] cut through the mountains by a cañon, with nearly vertical walls [illegible] feet high!

the grass grows well, and therefore trees became very scarce when we entered the "Cretaceous formation No. 1," which is of a porous character, not retaining moisture in its strata like many parts of the Tertiary farther down, though covered with a very close growth of grass. As usual throughout the route it is the slopes facing the north that have most of the woods on them. The species met with were the eastern *Pinus rigida* and *Juniperus Virginiana*, the boreal *J. communis*, the western *Pinus monticola* and *Abies Douglassii*. If any other occurs it is, probably, *Pinus ponderosa*, which grows in the Black Hills toward the south-east, according to Dr. Hayden.

Along the rivers a different group, the deciduous trees found in that situation throughout the plains of the Missouri basin, reached a little above Milk river, nearly all, however, ceasing at the point where the mountain woods begin.* Above here only *Populus balsamifera* occurs in scattered spots with stunted shrubs of *Negundo aceroides* and *Prunus Virginiana*, so that for several days below Fort Benton, one hundred and seventy-five miles by the river, the boats could scarcely obtain enough wood for fuel, and there is almost none to be seen. *Populus angustifolia* also begins at Maria's river, and is the prevailing species along the upper branches of the Missouri. The same destitution of wood continues from Fort Benton to the "Gate of the Mountains" along the Missouri, though its branches are better supplied with the same trees. Thus the influence of the soil belonging to "Cretaceous No. 1" is the same throughout its limits, but I believe is due to the causes above mentioned rather than to its Cretaceous nature, since on the lower Missouri it is much more productive of timber than "No. 4" of Dr. Hayden's section, or his "lignite tertiary basin," probably because it there receives more rain.

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*Those seen below *only* (above Fort Union) were *Fraxinus Americana* (or *sambucifolia?* or both) and *Ulmus Americana*, the former pretty common, the latter rare. *Quercus macrocarpa* does not pass the Yellowstone.

Though we merely skirted the northern limits of the Hesperian region it shows, even there, sufficient distinctness of products to separate it from the "Dacotan" east of Milk river. Even its woodless plains differ materially in vegetation, having a better growth of grass, and in some very sandy tracts, presenting the shrubby forests characterizing the whole "Rocky Mountain Province." It evidently runs into the "Saskatchewan" region to the north, which is truly a "Campestrian" one. Farther explorations will doubtless reveal more spurs of the Rocky Mountains near the one hundred and seventh meridian, with the western trees covering them, and the fall of the Missouri, with its lofty cliffs throughout this region, plainly shows that even the plains form an elevated plateau, or basin, from which the descent to the "Dacotah" plains is by a sort of step, often sudden, or marked by the protrusion of lower rocks above or near to the surface. I have generally found that the *base* of a mountain range formed a stronger limit to the range of species of trees than the summit, and this fact is illustrated in the present case by the change occurring above Milk river at the first mountain range. The rule extends also to other plants and to animals, as all explorers will testify.

At the eastern base of the Rocky Mountains proper, where the Missouri literally cuts through them, the fact is repeated, and there I found the following western trees, which will probably be found also to reach the more eastern ranges: *Acer glabrum* (*tripartitum* is a variety), *Betula occidentalis*, *Alnus incana* or *rubra?* (*viridis* is a boreal species), and *Populus angustifolia*. *Amelanchier alnifolia*, although a tree on the west side, is but a shrub on the east side of the mountains, from the influence of a drier climate. It is said to extend to Lake Superior. *Populus tremuloides* is also a boreal species, occurring in the mountains everywhere above a certain elevation. Some other boreal species have been found by Dr. Hayden to straggle to the Black Hills, such as *Pinus Banksiana*, *Abies nigra* (and *alba?*). Though

I did not find them I have no doubt of their identity, having seen the specimens. It is somewhat singular that all the fresh-water mollusca I found in the Missouri, above Fort Benton, were distinct species from those obtained by Dr. Hayden in the streams east of the mountains (except *Unio luteolus* and *Physa heterostropha*), thus showing that the limits of the region apply to animals as well as plants. The rest were *Limnæa palustris*, *bulimoides* and *desidiosa*, *Sphærium striatinum* and *Margaritana falcata* Gld. Dr. Hayden found thirty other species in Nebraska.

Kootenay region.—My observations last summer confirm the propriety of this division of the north-western province (*Caurine*), being defined towards the south essentially as I marked its limits in the Smithsonian Report of 1858. It consists, south of latitude 49°, chiefly of the elevated basin of Clark's Fork, with the mountains which surround or traverse it, nearly all being more than 2000 feet above the sea (about 4000 feet where we crossed the Bitterroot), and from that extends up to perpetual snow at probably a level of 10000 feet.

Though, as shown by the accompanying notes, the western rim of this basin presents many marked differences from the portion east of the Bitterroot crossing, analogous to those between the Coast and Cascade Ranges farther west, I cannot now consider them distinct regions, but as united by the common character of being almost completely wooded. This character must also annex to it the lower country along the Spokan and the Columbia above that tributary, most of which is, however, so mountainous as to reach as high as the basin of Clark's Fork. The woodless portions of this region were small in extent along our route, being limited to the porous, dry tertiary and alluvial basins of Deer Lodge and St. Mary's valley, with small tracts in the valleys connecting and branching from them. The most extensive prairies are south of our route, towards the heads of these valleys, with a connected valley toward the north on Flathead river. So

generally are these prairies limited to the porous strata of the later formations that I believe some tracts of high prairie on the western slope of the Rocky Mountains indicate the presence either of tertiary or deep beds of drift, which latter cover the prairie summit of Mullan's Pass. It must be remembered, however, that this relation to different strata is the only one depending on their porosity, and that where rains are more abundant this ceases to prevent the growth of trees. Strata resembling the Cretaceous of Nebraska in density are on the west side thickly wooded, so that there is no indication of their nature from the absence of trees. The impervious rocks and thin soil of the Cœur d'Aleñe Range evidently assist the more rainy climate in producing a moisture fitted for the peculiar group of trees characterizing it, and there is a more marked difference in its opposite slopes than in those of the Rocky Mountains, more striking, however, on account of the greater number of species of trees found there. The contrast is most important between the west slope of the western rim and the east slope of the eastern.

Many facts show that the trees are more dependent on a certain supply of water than on temperature, as will be seen by comparing the profile of the route with the distribution of the species. Thus on the Rocky Mountains *Pinus contorta* grows only between 5000 and 6000 (or more) feet of elevation, an altitude just sufficient to catch the moisture passing over the general summits of the Cœur d'Alêne Mountains, in which the pass we went through is 5100 feet high. It reappears at the east base of the latter range, because of the impervious rock there, and the increased moisture deposited on that rim. The various relations of other trees to the influence of moisture are shown briefly by the following facts of their distribution and growth:

Cerasus Virginiana?, *Amelanchier alnifolia*, *Populus angustifolia* and *Pinus ponderosa* are distributed entirely across, but are most highly developed along the Blackfoot

and Hell Gate valleys, forming the lower half of the east side of the basin, where there is, probably, a moderately dry and warm summer.

Acer glabrum (and var. *tripartitum*), *Betula occidentalis*, *Alnus rubra?* *Abies Douglassii* and *Cratægus rivularis* grow throughout but thrive most at the west base of the Cœur d'Aleñe Mountains, where there is much more rain and hotter summers (being 2000 feet lower in elevation).

Populus balsamifera and *Pinus contorta* are almost equally wide-spread; they are probably finest on the east slope of the Cœur d'Aleñe Range, where there is a comparatively rainy and cold climate which also favors the variety of *Abies grandis*, called *amabilis*.

Populus tremuloides and *Juniperus Virginiana* are so scantily distributed that no part of the mountains seems to suit them well, though found at intervals in gravelly soil where there is not much shade.

Larix occidentalis is mostly limited to the western rim, and is finest on its western slope.

Cornus pubescens and *Thuja gigantea* merely struggle up the Bitterroot river to the crossing, but are finely developed at the west base of the western rim with *Acer glabrum*, etc.

Pinus monticola is very scarce on the eastern rim and slope; it is a magnificent and abundant tree on the western, and finest near its summit.

Frangula Purshiana, *Pyrus fraxinifolia?* and *Abies grandis* are found over the whole western rim, but are chiefly developed on its western slope and base.

Abies Menziesii is limited to its higher parts above 4000 feet elevation. *A. Williamsonii* to those above 4500 feet.

Abies Mertensiana and *Taxus brevifolia* just straggle to its eastern slope, but are large and numerous on the western between 2000 and 4500 feet elevation.

Finally, *Cratægus sanguinea* and *Cerasus mollis* are confined to the lowest and warmest portions.

Thus while nearly all are found on the western rim, and

most of them grow largest on its western slope, only half of them reached the eastern rim along our route, and several of these were merely stragglers. This accords with the general rule that the most trees, both in number and species, grow where the most heat and moisture are combined. The forests of the western rim are far denser than those of the eastern, though the soil cannot be considered generally so good on account of the kinds of rocks from which it is disintegrated.

An exactly parallel case is presented by the Cascade and Coast Ranges, as described in the Natural History of Washington Territory (Pacific R. R. Reports), but there the species, though mostly the same, are somewhat differently arranged to correspond with differences in climate, consequent on the much lower elevation of those ranges and their nearness to the ocean. Yet we there find *Pinus contorta*, *Thuja gigantea*, *Abies Menziesii*, *A. Mertensiana* and *Taxus brevifolia* among the prevailing species at the level of the ocean, while here they do not occur lower than 2000 feet above it, showing that they require moisture rather than coolness of climate, for at the coast the rains are heavier while the mean temperature is far more mild than here. But *Pinus ponderosa*, *Acer glabrum*, *Betula occidentalis*, *Cratægus rivularis*, *Larix occidentalis*, *Pinus monticola*, *Pyrus fraxinifolia* and *Abies Williamsonii*, here characteristic trees, scarcely, if at all, cross the Cascade Range, while *Abies Douglassii*, and several peculiar species not found here, replace them between that and the Coast Range.

It is therefore much safer to assume a similarity in the moisture of the climate and soil of two regions thus widely separated, from comparison of their forests, than similarity in temperature. I am here comparing portions of two regions included between the same degrees of latitude, but according to another rule dependent on the climate of the western regions, all the above species of Rocky Mountain trees are found, or probably will be found to reach the coast

either north or south of these parallels, wherever they find the proper amount of rain and heat as combined in these mountains.

Shoshonee region.—The Great Columbia Plains show their peculiar features in prairies extending through the valleys on the route north to Fort Colville, which are, however, so small in extent compared with the forests, as not to be separable from the Kootenay region. Just north of the Spokan are the first extensive plains on the uplands, and to the south these become rapidly spread to the entire exclusion of forest, so that for days together not a tree is seen except shrubby willows on the banks of streams. Even the Blue Mountains show but a narrow strip of timber just along their summits in latitude 46°, which is said to disappear farther south, though the upper waters of the rivers flowing from them are pretty well wooded with deciduous trees. The only new ones that occur, and these only as stragglers from the south, are *Rhus glabra?*, *Celtis reticulata* and, perhaps, *Cratœgus sanguinea?*, if more than a variety of *C. rivularis*. On the Walla Walla river are also found *Populus angustifolia*, *P. monilifera*, *Alnus rubra?* and *Betula occidentalis*. Some of the willows are, probably, also distinct from those of the mountains, but being undeterminable from leaves alone, I have omitted them throughout these remarks. (See notes on the trees observed, p. 405.)

A brief comparison of this with the plains of regions east of the Rocky Mountains, will show how little connection exists between soils or rocks and the growth of trees, how much depends on a proper amount of moisture.

The entire plain is underlaid by basalt, covered thinly with a fine dusty soil, which I believe to have been also volcanic in origin, having been poured out with lava in the form of mud. In parts this has been blown into high ridges, while in others it is washed entirely away, leaving the bare rock at the surface. This makes no difference however in regard to the trees, and little to other vegeta-

tion. This soil, on some ridges north of the Spokan where there is not much rain, is the richest I saw on the whole route, and produces fine crops near Antoine Plant's prairie. To the south it is covered with grass, etc., and where naturally irrigated by streams, other plants grow luxuriantly. There is then nothing unfavorable to trees in the soil, and indeed, west of the Cascade Range, almost the whole country is basaltic and covered with dense forests. We must look therefore to dryness as the cause of their absence, and so far the observations of the Medical Department, U. S. A., at Fort Walla Walla, Dalles, and Sincoe, show a remarkably small amount of moisture. For particulars, however, I must refer to the "Report on Statistics," etc., of Surgeon General Lawson, for 1860, prepared by Dr. Richard H. Coolidge, U. S. Army.

THE GOLDEN WINGED WOODPECKER.

BY AUGUSTUS FOWLER.

THIS is an exceedingly valuable bird, especially if it resides near lands of a light or sandy soil. Its food is almost wholly composed of insects, of which ants form the principal living of the young fledged birds. These insects perform themselves into colonies, and excavate, a little below the surface of the soil, one or more chambers, with galleries leading to them, bringing the soil from around the roots of the grass, leaving them to a free circulation of air, that soon causes them to wither. The Woodpecker sits by the mound of dirt thrown out by the insects, and as one appears creeping from his den the bird draws him into his mouth with its tongue, and swallowing him, continues to do so until he has destroyed the whole republic. I have examined the birds at such times and have found their stomachs distended to their fullest extent; indeed it seemed as if they could not

contain one more insect, and yet, when taken, they were still in the act of devouring them.

The sagacity of these birds is wonderful in determining the locality of an insect that is concealed in the branches of trees, or in the solid trunk of a sapling. Instances daily occur of the benefits of the Woodpecker in extracting the borer from trees, and so nicely does he determine their exact locality that his first effort to secure his prize is successful. The bird alights on the trunk of the tree; the fact that a borer is gnawing at its heart is evident to him, and he hops around and down the tree, giving it a few taps with his bill, then slowly ascending and continuing the strokes lightly, when suddenly he stops and strikes a few successive strokes in the same place. He stops longer at that spot than at any other; he moves up the tree and taps there, but descends immediately to his last position. He has determined by the sound the locality of the worm and prepares to take him out. Fixing himself firmly on the side of the tree he throws his head back, and with a powerful stroke drives his chisel-pointed bill quite through the bark and into the solid wood of the tree. Stroke succeeds stroke in earnest repetition until he strikes upon his victim, and then thrusting his long barbed tongue into his body draws him out and devours him.

The Golden-winged Woodpeckers are, in some instances, permanent residents in New England; the larger part of them, however, migrate South, and return from the middle to the last of March. After having returned and selected their mates they soon begin to look up a place for a residence. The tree being selected they begin excavating it by digging a round hole, about two inches and a half in diameter, for the entrance, and continuing it the same size for one or two inches, then immediately widen it to about seven and a half or eight inches in diameter, and extend it about the same size to a depth of from eighteen to twenty inches, when it is finished. The chips they make in excavating it, except a

few of the finest, are mostly thrown out of the entrance on the ground, which reveals their nesting place.

In the few chips remaining in the hole the female makes a slight hollow, and lays from six to eight semi-transparent and highly polished white eggs. They measure $1\frac{1}{12}$ of an inch in length, by $\frac{7}{8}$ of an inch in breadth. While incubation is going on, the male, when he relieves the female from setting, flies to the tree and alights near the entrance, and emits the notes resembling in sound the syllables "flicker—flicker," and peeps around the tree at the entrance to see when the female leaves. On hearing him she quits the nest, when he immediately takes charge of the eggs until she returns. When the young are large enough they leave the cavity and creep to the top of the tree, locating themselves on different parts of it, and are fed by the old birds until they can fly quite well, when they are taken to the fields and pastures or woodlands, where they soon learn to provide for themselves. Although the usual number of eggs laid by these birds for a brood are from six to eight, yet they will sometimes lay a hundred, when they are taken from the nest as often as they are laid, leaving one for a nest egg. Tests have been made of the number of eggs they would hatch at one setting. A dozen of eggs were taken from the nest of one, and then the bird was allowed to lay the usual number for a brood; then to these the number that were taken were added, and the bird commenced setting. In due time the eggs were hatched, and when the young birds were large enough to creep about the tree, it literally swarmed with young woodpeckers.

These birds suffer exceedingly from the depredations of the Mottled Owl. I seldom find the breeding-place of this owl without finding the wing feathers of the woodpecker scattered about it in greater quantities than those of any other birds. They often alight upon the ground, and perch crosswise on a limb of a tree, a thing which other species of woodpeckers are not accustomed to do. The Downy

Woodpecker (*Picus pubescens*) is a no less interesting bird than the Golden-winged Woodpecker (*Colaptes auratus*). They are equally beneficial and much more familiar. They breed in the orchard and in the trees about our dwellings with as much confidence as in the forest, and visit us in all seasons of the year, and are especially welcome in winter.

This bird receives the opprobrious name of "sap-sucker," a reproach which none casts upon him but the ignorant, who condemn him as mischievous without investigation, and then wickedly execute their judgment without mercy. In the latter part of September, and in all the months of October and November, this bird enters the orchard and selects those trees which have the smoothest bark and are the healthiest, and begins to pick small holes about one-quarter of an inch in diameter, quite through the bark, and from half an inch to an inch apart, in parallel lines around the trunk of the tree, which circles of holes are from one to two inches above each other. These lines of holes are extended up the whole length of the trunk of the tree, and sometimes around the larger limbs diverging from it.

It is well known that some of the insects injurious to fruit trees deposit their eggs in the latter part of summer and in the autumn, laying them under the bark and in crevices about the tree, in fact in any secret place they find. As they ascend the tree, perforated by the woodpecker, they are not at a loss to find a suitable place for their purpose. If they pass the first, second, or third tier of holes, there are others above them as well adapted to their wants, and in them they may deposit their eggs, and cover them with a covering indestructible by the weather. Others find in them a retreat from daylight and from storms, and in them some other insects lie dormant, shrouded in their silken cocoons. In this we see the wisdom of the Creator who supplies the wants of all his creatures. He teaches the ant, the squirrel, and the bee, to hoard and gather for themselves a sufficiency of food for winter; but to the Downy Woodpecker he has

given quite a different instinct. He has taught it to be a hunter, and has taught it also to know the habits of its game, and when, and where, and how to set its traps. How often do we see in winter and early spring, the Downy Woodpecker followed by a troop of Chickadees, visiting every tree in the garden, especially those that have been perforated by itself, searching every hole and crevice for insects and their eggs. It shows no disposition to quarrel with its company, but rather seems to take pleasure in directing their course through the forest and orchard by the notes of its shrill clarion voice. It admits the Nuthatch and Brown Creeper to its society, who join it with the full assurance of its friendship, and they roam with it in storm and in sunshine over a vast territory, destroying in their course millions of vermin in the embryo state. The insect-eating birds that visit us in the spring and stop a few months, retiring in autumn, are very beneficial to the horticulturist, but their services are not to be compared to those of the resident birds which feed upon insects in every stage of their life.

The Downy Woodpecker perforates decayed trees, or their branches, for their nesting places. When they select a horizontal branch, as they often do, they make a cavity in the limb to the extent of from ten to fifteen inches, towards the trunk of the tree, having the entrance leading to it on the underside of the branch; in such cases their nests are difficult to find. When they select an upright branch, or the trunk of a tree, it is dug out to the depth of from eight to twelve inches, and in the bottom of the hole, on the chips left for the purpose, the female deposits four or six pure white eggs, which measure in length six-eighths of an inch, and in breadth five-eighths of an inch.

To show what diligent and persevering birds they are, I will state a fact. A pair of Downy Woodpeckers selected a branch of a chestnut tree, which was broken off about four feet from the trunk of it, and about ten feet from the

ground. In it the birds had determined to make their home and began their operations. It was a piece of wood dried and thoroughly seasoned, without the least sign of decay. In the first day's labor, which was chiefly done by the male, they succeeded in penetrating the limb about one and one-half inches. The hole was conical in shape, the outer circle being finished or made large enough to admit the birds; then it gradually tapered to the smallest point. The second day they commenced to beat out the hole of sufficient size and depth, which was slowly executed, as hardly a particle of wood could be seen to fly off before their bills; yet they persevered, and in eleven days they succeeded in completing it, by digging four inches below the aperture. Although it cost the birds much time to procure this tenement they had the satisfaction of knowing it was a good one. There was no smell of rotten wood about it, but was clean, dry, and smoothly finished. In this nest were reared five young woodpeckers. The male was mostly seen about the premises, and I think he did the most labor in preparing their abode. When the young appeared he was also diligent in procuring their food.

In winter the Downy Woodpecker sometimes digs a hole in some rotten tree for a retreat in stormy weather, and to roost in.

NATURAL CARVINGS.

BY PROF. A. M. EDWARDS.

MANY of our readers have doubtless often admired and wondered at the exquisite carved ivory work sent forth by that strange, industrious, and ingenious people, the Chinese. No examples of their manipulative skill have attracted more attention, perhaps, than those balls within balls, each one more elaborately decorated than the other,

which, at one time, were by no means common out of China, and, therefore, brought very high prices. Of late years, however, the natural result of such a demand has been a plentiful supply, so that what were once rarities are now rather common ornaments in many houses. And although travellers in those foreign parts have come back and endeavored to dispel the mystery that has ever hung around these strange examples of a strange people, by telling us that they are not made from one piece of solid ivory, but carved separately and then moulded one over the other, yet they still remain objects of great interest and beauty.

What will the admiring collector say, however, when we tell him that there exist objects almost the counterpart of these Chinese ivory balls, the substance of which is glass-like, consisting of pure silica, or the same material as rock-crystal, but which are thus formed and fashioned by animals? And shall we increase his wonder by informing him that the beauty of these objects is very materially heightened by the fact that they are of minute dimensions, so small in fact, that they can only just be seen by the unaided eye, but when examined by sufficiently powerful magnifying glasses, exhibit a much greater variety of contour and sculpture than even the most fantastically formed oriental handiwork! These are known to scientific observers as *Polycistineæ*, and it is our intention to say a few words respecting these objects, concerning whose life-history, it is true, very little is known, but which form beautiful subjects for examination by means of the microscope.

In Plate 7 are represented a few of the many varied forms presented by the Polycistineæ, and what is with certainty known concerning them, we give as follows. First, however, so as to make the subject readily understood, we must say something with regard to two other classes of very simple animals, which, in the modern system of classification, are placed first in the list. These are the *Gregarinida* and *Rhizopoda*.

The *Gregarinida*, so called from a Greek word meaning a flock, on account of the mode of congregating together which these creatures possess, "are among the simplest forms of animal life of which we have any knowledge. They are the inhabitants of the bodies of other and larger creatures, and are commonly to be found in abundance in the alimentary canal of the common cockroach, and in earthworms. They are all microscopic, and any one of them, leaving minor modifications aside, may be said to consist of a sac, composed of a more or less structureless, not very well-defined, membrane, containing a soft semi-fluid substance, in the middle, or at one end, of which lies a delicate vesicle; in the centre of the latter is a more solid particle." This is the whole of the anatomy of these creatures, no mouth nor organs of any kind being apparent, so that they are placed at the point where it may be said that animal life dawns.

Next to the *Gregarinida*, in the scale of being, stand the *Rhizopoda*. "It seems difficult to imagine a state of organization lower than that of the *Gregarinida*, and yet many of the *Rhizopoda* are still simpler. Nor is there any group of the animal kingdom which more admirably illustrates a very well founded doctrine, and one which was often advocated by John Hunter, that life is the cause and not the consequence of organization; for, in these lowest forms of animal life, there is absolutely nothing worthy of the name of organization to be discovered by the microscopist, though assisted by the beautiful instruments that are now constructed. In the substance of many of these creatures, nothing is to be discerned but a mass of jelly, which might be represented by a little particle of thin glue. Not that it corresponds with the latter in composition, but it has that texture and sort of aspect; it is structureless and organless, and without definitely formed parts. Nevertheless it possesses all the essential properties and characters of vitality; it is produced from a body like itself; it is capable of assim-

ilating nourishment, and of exerting movements. Nay, more, it can produce a shell; a structure, in many cases, of extraordinary complexity and most singular beauty." With the *Rhizopoda*, however, we have not to do at present; at some future time we shall take the opportunity of presenting our readers with some figures illustrating the grace exhibited in some of their hard tissues, or skeletons, as we may rightly term them.

Our Polycistineæ belong to a class of animals very nearly allied to those we have just been speaking of, and named by naturalists *Radiolaria*. This name has been given to them on account of the radiating arrangement of their parts, such parts being grouped, generally, around a common centre. These simple forms of life consist of microscopic masses of the semigelatinous substance we have already spoken of, and which is known as sarcode, meaning matter, as it were, on the way to become flesh, or protoplasm, from words designating the first form of matter. This term, however, is more commonly applied to the primitive tissue of the embryo or egg, out of which all subsequent organs are formed by a peculiar process, termed differentiation. From this mass of sarcode, constituting the whole mass of the animal proper of the Radiolarian organism, are protruded filaments, which are often extremely long and slender, and have been named *pseudopodia*, from two words meaning false feet; for these projections act as feet to the creature which throws them out, serving not only as organs of propulsion but to secure its prey and convey its food into the position for assimilation, and the building up of new tissues. This sarcode is such a peculiar kind of substance that the pseudopodia, as they are thrown out, may remain single or unite so as to form reticulations, or even coalesce into one mass around any particle of nutrient matter which they come in contact with. Scattered throughout it, generally, are to be found numerous yellow corpuscles, which multiply by fission, as it is called, or division, and to these parts a skele-

ton may be added, consisting merely of fine pin-like masses, or spicula, and these may be loose or united into a solid shell of great beauty of form and sculpture, as our Plate shows, or the skeleton is an assemblage of stout rods meeting in the middle of the creature, where a sac is found, and pointing in all directions. Here we see the applicability of the name given to the class of Radiolaria. No reproduction, by means of a true sexual process, has been as yet observed in any Radiolarian, and therefore here is opened a very promising and attractive field of research for the naturalist.

For the most that is known of the Polycistineæ, in their living condition, we are indebted to Prof. Müller, a celebrated German naturalist; but their remains, or shells, which are preserved in certain rocks in different parts of the world have been investigated and figured by the great microscopist of Berlin, Ehrenberg. He first discovered them in the mud brought up from the bed of the river Elbe, at Cuxhaven, and afterwards he found them in similar collections made in the antarctic seas. Prof. Bailey, one of the first and most enthusiastic American naturalists, also observed them, accompanied by other organisms, both animal and vegetable, in soundings, brought up by the lead from the bottom of the Atlantic Ocean, at depths of from 1000 to 2000 fathoms. So, also, the sea-bottom which has been procured from the Gulf of Mexico, off the coast of Florida, in some quantity, by means of a peculiar apparatus specially constructed for the purpose, is seen to be extremely rich in some of the more exquisite forms of these glassy shells. The microscope has thus revealed the existence of an universe of life at the bottom of the ocean. Of course the soundings made previous to the laying of the Atlantic Telegraph cable told the same story; here, as elsewhere, the sea-bed is overlaid with a carpet of the silicious remains of these beauteous atoms. During some past geological periods, however, it would seem that the Polycistineæ existed in much greater numbers than at the present time, for certain strata of con-

siderable thickness are found, on examination, to be made up almost entirely of their silicious skeletons. Thus in the chalks and marls of Sicily and Greece, Ehrenberg detected vast numbers of forms; and at Oran, in the north of Africa, is an extensive stratum made up of the remains of Polycistineæ and similar organisms, both animal and vegetable. The famous infusorial strata of the States of Virginia and Maryland on our Atlantic coast, and of California on the Pacific, have, mixed with the minute plants known as Diatomaceæ, many very fine species of Polycistineæ, as well as the remains of sponges. The most remarkable deposit, however, of this character is that which makes up the greater part of the island of Barbadoes. This rock is, in many places, almost entirely formed of these glassy shells. The materials which led to this discovery, in the year 1846, were furnished by the geological researches of Sir. R. H. Schomburgh, hence one of the most beautiful species has been named after him.

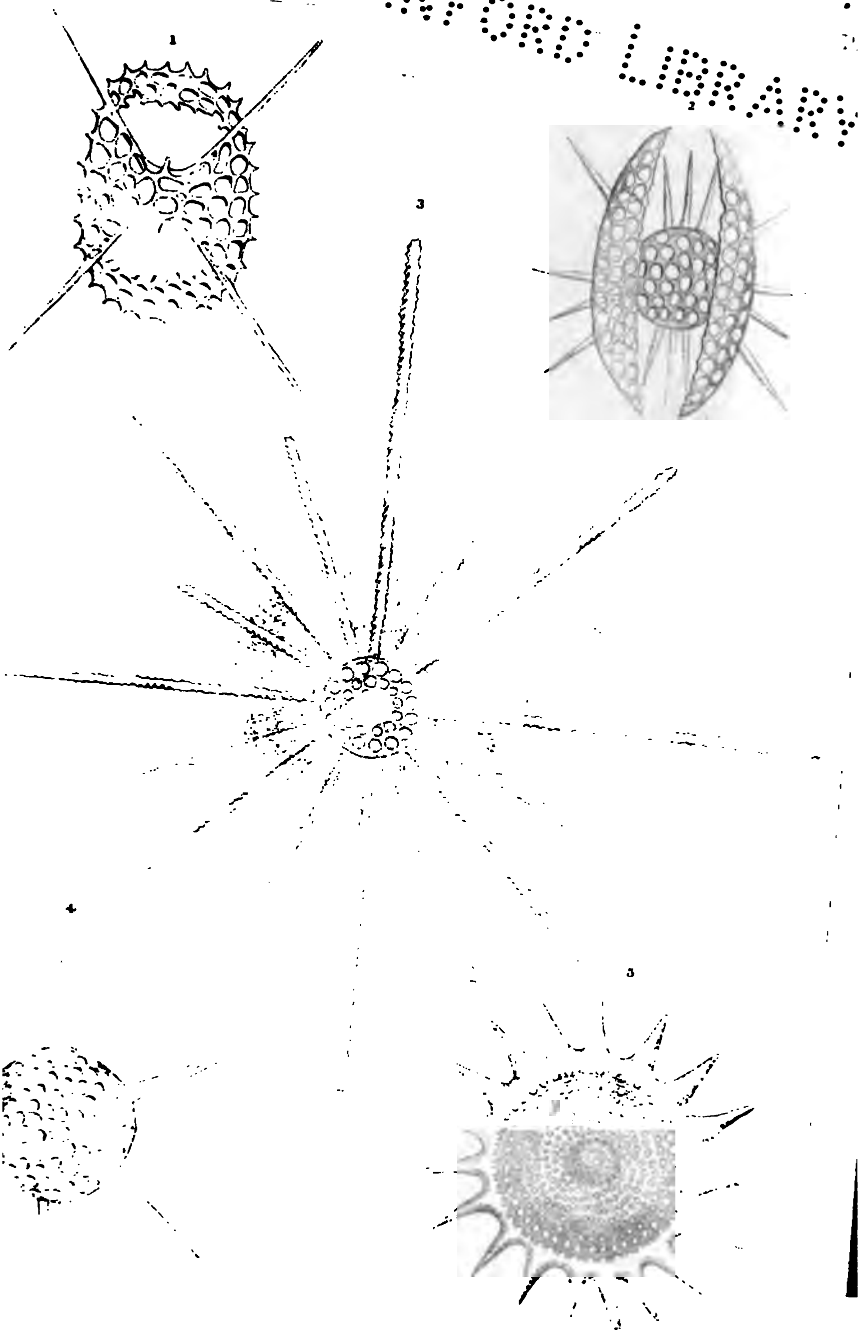
The variety of form and outline which the Polycistineæ assume is very great, and always of great beauty and grace, while their minute dimensions make them, if possible, still greater sources of admiration to the student of nature who thus finding strata of rocks, of considerable thickness, made up of their delicate remains feels the truth of the words of the poet, when he says—

"The dust we walk upon was once alive."

REVIEWS.

THE METAMORPHOSIS OF CRABS.*—That insects undergo a metamorphosis was known by the ancients; the discovery that crabs and worms undergo a true metamorphosis, scarcely less striking than that of insects, is not more than thirty years old. The Nauplius form, here figured, was known to naturalists in the days of O. F. Müller (who wrote a

* Fur Darwin. Von Fritz Muller. With sixty-seven woodcuts. Leipzig, 1864. 8vo, pp. 91. Also recently translated and published in London by Van Voorst.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work on Crustacea in 1785) and was known to be the young of the little Cyclops and Cypris, which swim in fresh water and tidal pools; and the strange Zoëa was made known in 1802 by Bosc, who described it as an Entomostracan under the name of *Zoe pelagica*. That, however, the Zoëa was simply a young crab was shown by J. V. Thompson, in 1836, and that the earliest stage of the shrimp began with a Nauplius form is a still more recent discovery, and so remarkable in its bearings on the classification of the Crustacea, and the philosophic study of the Crustacea generally, that an explanation of how crabs and shrimps grow may be welcome to our readers. For a summary of the facts here presented we are especially indebted to Fritz Müller's "*Für Darwin*," a book called forth by Darwin's Origin of Species, and written by a strong and able advocate of developmental views, and which has just been translated into English by Mr. Dallas. We have often watched the Nauplius of the water fleas, Cyclops, etc., swimming about in a small fresh water aquarium, when they closely resemble young mites. Indeed the spiders (Arachnida) seem in the young of their degraded forms to mimic wonderfully the young of the Crustacea, so that the two forms would seem at a casual glance, hardly to belong to different genera, and it is a most significant fact that these two great groups seem to run into each other here, so that their limits seem indistinguishable, and we only know that one is a young spider and the other a young shrimp by tracing their life history farther on. Again, the border land of the Crustacean world and the spider world fade insensibly into each other when we have before us a Pycnogonid or Sea-spider, and a Harvest-man for example, and it is only by going up the scale, and by intermediate forms tracing the relationship of the one to the crabs, and of the other to the true spiders, that we realize that the two worlds seem to touch

Fig. 72.

Fig. 73.

at only a single spot, and that even then the contact is not real. In fact the Nauplius is a larva, and as the insect world seems to touch upon the worm world when a caterpillar or dipterous larva is before us, so the larva of the mite and the larva of the crab assume a common form, though potentially so divergent. It is only a partial view that would unite the Arachnids with the Crustacea because of the identity in form of their larval stages, or of certain degraded forms. Among insects we do [illegible] know the Stylops alone by the sac-like female scarcely [illegible] highly organized, so far as externals go, than the Peltogaster, but consider also [illegible] active, highly organized, [illegible] Stylops, a being so widely divergent in external form from its mate, and though the difference is only sexual in its nature, yet reaching almost as far as the difference between classes in the animal kingdom.

Fig. 74.

Fig. 72 represents an embryo of a Corophium, magnified ninety diameters; the mouth-parts are similar to the legs in form. The yolk mass (y) lies on the back of the animal; h is the head, and m the mouth-parts.

Fig. 73.

Fig. 73 represents the larva, or "Nauplius," of a shrimp, magnified forty-five diameters. The body is soft, oval, in form somewhat like a mite, and with three pairs of short thick legs, of which the front pair are simple, ending in long simple bristles, while the two hinder pairs are divided into two portions, each bearing two or more spinulated bristles; and the end of the body is square, with two bristles.

After moulting this skin the animal acquires a pair of jaws and the fore and middle pair of foot-jaws; the body is much larger and the front part is greatly enlarged and protected by the shield-like head-thorax, which is now distinct and rounded in form. As the number of feet have

become more numerous, they are smaller than before, and the anatomy of the internal organs is more complex. At the end of the body, now much elongated, is a pair of short feet, ending in several bristles. This is the Zoëa stage (Fig. 74, enlarged forty-five diameters) and corresponds to the Zoëa of the Crab, *Carcinas mænas* (Fig. 75; *a*, natural size), discovered by Thompson.

THE CANADIAN ENTOMOLOGIST completed its first volume in July. The Editor, Rev. C. J. S. Bethune, Credit, Canada, announces that the publication will be continued and the number of pages of each number be increased from eight to at least twelve, and, if sufficiently encouraged, to sixteen, while the annual subscription will be increased from 50 cents to $1.00. We hope this journal will be sustained, for it is a credit to Canadian entomology.

THE AMERICAN ENTOMOLOGIST.—The August number, which comes to us in an attractive cover, is the last of Vol. i. The Editors announce that hereafter each number will consist of thirty-two pages instead of twenty-four, and the annual subscription has been raised from $1.00 to $2.00. The present number abounds with illustrations, while the paper is improved in quality. The magazine cannot fail to satisfy those who wish for information regarding our noxious and beneficial insects.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.—The Eighteenth Annual Meeting of the Association was held August 18-25, at Salem, Mass. From the great number of papers presented, their high scientific character, and the large number of members present, the meeting was judged by many to have been, both in a scientific and social point of view, the most brilliant and successful one that has been held for many years. About two hundred and seventy-five members were present and one hundred and sixty-three papers were presented. A great deal of business was dispatched, and the legitimate objects of the Association so closely adhered to that invitations from various societies in Boston and Cambridge, the city authorities of Boston, and other places, were reluctantly refused in order that each paper should have a hearing. One day (Saturday) was given up to the enjoyment of a steamboat excursion about Massachusetts Bay, given by the city of Salem.

This meeting was signalized by the formation of two new subsections of Section B, viz.: *Archæology* and *Ethnology*; and *Microscopy*.

There was also held during the session a microscopic convention which proved very successful and interesting to microscopists, and as the standard of instruments made in the United States is not surpassed by those

of England, France or Germany, we hope this section will continue to flourish and increase in influence and importance, and stimulate our manufacturers of microscopes, and observers, to still greater perfection in the construction and use of this instrument. As a Natural History journal we are not called upon to report the doings of Section A, Mathematics, Physics and Chemistry, but we should say that its meetings were this year especially interesting from the numerous papers on the recent eclipse which were presented.

The American Association dates its origin as far back as 1840, when some eighteen gentlemen, connected with the geological surveys then in progress, met in the hall of the Franklin Institute, Philadelphia, and organized an association under the name of "The Association of American Geologists." At the meeting held in 1842 the name was changed so as to read "The Association of American Geologists and Naturalists," and in 1847 its sphere was enlarged and its present name adopted; thus embracing every department of science.

The meetings were suspended during the years 1861–65, but since the war they have increased in value and the number of those in attendance, and both this and the last meeting have demonstrated that the American Association fully accords with the genius of our people and institutions, and that as promoting good fellowship and harmony among scientific men, and placing them in a more direct relation with the people, the value of these annual reunions cannot be too highly estimated.

An important change in the Constitution was proposed, which, if adopted at the next meeting, will greatly facilitate business, and will place all the Sections on an equal footing. The change proposed is as follows: Rule V to read —

"The Association shall be divided into *two* sections, A and B. Section A to be divided into the following subsections: 1, Mathematics and Astronomy; 2, Physics and Chemistry; 3, Microscopy. Section B into the following: 1, Geology and Palæontology; 2, Zoölogy and Botany; 3, Archæology and Ethnology. The two sections may meet as one."

It was voted that the next meeting be held at Troy, N. Y., on the first Wednesday in August.

Officers present at the Meeting: J. W. Foster, *President*; F. W. Putnam, *Acting Permanent Secretary*; O. C. Marsh, *General Secretary*; J. W. Foster, F. W. Putnam, O. C. Marsh, B. A. Gould, Louis Agassiz, Joseph Henry, Benjamin Peirce, John Torrey, T. Sterry Hunt, J. S. Newberry, Alexis Caswell, W. C. Kerr, *Standing Committee*. (Messrs. Rood, Lovering, Elwyn, Rockwell and Whittlesey were absent.)

Section B. (Natural History) — Prof. L. Agassiz, *Chairman*; Prof. T. Sterry Hunt and Rev. G. A. Leakin, *Secretaries*. Subsection C (Archæology and Ethnology) — Dr. E. G. Squier and Prof. Arnold Guyot, *Chairmen*; William H. Dall, *Secretary*. Subsection D. (Microscopy) — J. E. Gavitt, *Chairman*; E. Bicknell, *Secretary*.

PAPERS READ IN SECTION B.—NATURAL HISTORY.

On two New Genera of Extinct Cetacea. By *E. D. Cope.*
On the Early Stages of Brachiopods. By *E. S. Morse.*
On the Discovery of the Ammonoosuc Gold Field. By *Henry Wurtz.*
The Ammonoosuc Gold Field in New Hampshire and Vermont. By *C. H. Hitchcock.*
The Gems of the United States. By *A. C. Hamlin.*
On the Laws which Govern the Production of Sexes in Plants. By *Thomas Meehan.*
On a Remarkable Locality of Vertebrate Remains in the Tertiary of Nebraska. By *O. C. Marsh.*
On American Phyllopod Crustacea. By *A. E. Verrill.*
Note upon the Palæotrochis. By *Henry Wurtz.*
On the Homologies of the Palæchinidæ. By *Alex. E. R. Agassiz.*
Remarks on Trichina spiralis. By *J. Baker Edwards.*
On the Plumage of Terns. Communicated by Miss GRACE ANNA LEWIS.
On Norite or Labradorite Rock. By *T. Sterry Hunt.*
On the Geology and Geography of a part of the coast of Maine. By *John Johnston.*
On the Nature of Glands in Acacia and Cassia. By *Thomas Meehan.*
On the Valley of the Amazon. By *James Orton.*
Distribution of Coal, Iron, and the Precious Metals in China. By *A. S. Bickmore.*
On Embryonic Characters in American Salamanders. By *E. D. Cope.*
On the Metamorphosis of Siredon into Amblystoma. By *O. C. Marsh.*
On American Phyllopod Crustacea. By *A. E. Verrill.*
On the Nonfossiliferous Rocks of New England. By *N. T. True.*
Notes on the Geology of Hoboken. By *Henry Wurtz.*
Studies of the Red Sandstones of New Jersey. By *Henry Wurtz.*
Compression as an agent in Geological Metamorphism, with illustrations of distorted pebbles in conglomerates. By *G. L. Vose.*
On the Plasticity of Pebbles and Rocks. By *W. P. Blake.*
Hints on the Stratigraphy of the Palæozoic Rocks of Vermont. By *J. B. Perry.*
New Mosasauroid Reptiles from the Greensand of New Jersey. By *O. C. Marsh.*
Results of a late Geological Reconnoissance of Louisiana. By *E. W. Hilgard.*
On the Geology of Venezuela. By *R. P. Stevens.*
Observations on a New Genus of Polyzoa. By *A. Hyatt.*
The Rocky Mountain Alpine Region. By *C. C. Parry.*
Surface Changes in Maine since the close of the Quaternary Period. By *N. T. True.*
On the Geology of North-eastern America. By *T. Sterry Hunt.*
On Ancient Erosions in the St. Lawrence Valley. By *T. Sterry Hunt.*
Post Glacial Fossils at Hoboken, N. J. By *R. P. Stevens.*
Flora and Fauna of Fresh-water Tertiaries of Oregon and Idaho. By *J. S. Newberry.*
On the Trend of the Rocky Mountain Range north latitude 60°, and its Influence on Faunal Distribution. By *Wm. H. Dall.*
Relations of the Geology of Ohio to that of the adjoining States. By *J. S. Newberry.*
On New Species of Fishes obtained by Prof. Orton in the valleys of the Maranon and Napo. By *Theodore Gill.*
The Homologies and General Structural relations of the Polyzoa. By *A. Hyatt.*
On the Physical Geography and Geology of Brazil. By *Ch. Fred. Hartt.*
On the Cretaceous Age of Silver Deposits in Chihuahua, Mexico. By *J. P. Kimball.*
Notices of some new Tertiary and Cretaceous Fishes. By *O. C. Marsh.*
On the Tertiary Flora of Alaska. By *J. S. Newberry.*
On the Age and Relations of the Metamorphic Rocks of New Brunswick and Maine. By *George F. Matthew* and *L. W. Bailey.*
On the Raritan Clays of New Jersey. By *J. S. Newberry.*
On some points in the Geology of North Carolina. By *W. C. Kerr.*
Description of a New Species of Chiton. By *Wm. Prescott.*
Laws of Mountain Formation. By *J. S. Grimes.*
Notice of Fossils from Table Mountain, California. By *Wm. P. Blake.*
Comparison of the Coral Faunæ of the Atlantic and Pacific Coasts of the Isthmus of Darien, as bearing on the supposed former connection between the two Oceans. By *A. E. Verrill.*
On the Systematic Relations of the Lamarckian Pteroceræ. By *Theodore Gill.*
On certain Peculiarities in the Distribution of Marine Life on the Sea-bottom of the Bay of Fundy. By *A. E. Verrill.*
Preliminary Notice of the Lamellibranchiates of the Upper Helderberg, Hamilton, and Chemung Groups. By *James Hall.*
On some Recent Geological Changes in North-eastern Wisconsin. Communicated by G. R. Stuntz. Read by *J. S. Newberry.*
On Brazilian Drift. By *Ch. Fred. Hartt.*
New Fossil Plants from Gaspè. Discovered by J. W. Dawson. By *J. S. Newberry.*
On the Dyestone Fossil Iron Ore in Pennsylvania. By *J. P. Kimball.*
On the Classification of the Diurnal Lepidoptera. By *S. H. Scudder.*
The Morphology of the Abdominal Appendages of Butterflies. By *S. H. Scudder.*
The Value of the Characters drawn from the external Armature of Lepidopterous Larvæ. By *S. H. Scudder.*
A Classification of the Eggs of Butterflies. By *S. H. Scudder.*

SUBSECTION C.—ARCHÆOLOGY AND ETHNOLOGY.

Indian Migrations. In Four Sections. Sec. 1, Physical Geography of North America, with reference to Natural Highways; and Means of Natural Subsistence afforded by its Areas. Sec. 2, Agricultural Subsistence, and the Character and Extent of Indian Agriculture. Sec. 3, Migrations of Roving and partially Village Indians; deduced from languages, traditions, and known migrations. Sec. 4, Migration of Village Indians; as deduced from the same sources. By *L. H. Morgan*.

The Constitution of Man as modified by Light, Heat and Cold. By *Clinton Roosevelt*.

On the Botocudos of Brazil. By *Ch. Fred. Hartt*.

Observations on the Languages of South America, and the Classification of the Indian Nations thereof. By *Porter C. Bliss*.

On the boring of Stone Implements, illustrated by specimens collected by R. W. Haskins, from Indian Graves on the banks of the Ohio. By *F. W. Putnam*.

A Conjectural Explanation of the uses of the Embankments of the Mound Builders. By *L. H. Morgan*.

The Ainos, or Hairy Men of Yesso, Saghalien, and the Kurile Islands. By *A. S. Bickmore*.

Evidences of high antiquity in the Kjœkkenmœdden Deposits of New England. By *E. S. Morse*.

On the Distribution of the native Tribes of Alaska, and the adjacent Territory. By *W. H. Dall*.

SUBSECTION D.—MICROSCOPY.

On the Resolution of Microscopic Test Objects. By *A. M. Edwards*.

Some Remarks on an "Opaque Illuminator," applied to an Immersion Objective, and an Immersion Objective of Long Focal Distance. By *E. Bicknell*.

Some Remarks on the Infusorial Deposits of North America. By *A. M. Edwards*.

Note on a Phase in the Reproduction of a Confervaceous Alga belonging to the genus Œdogonium. By *A. M. Edwards*.

Mr. THOMAS MEEHAN read a paper "On the Laws which govern the production of sexes in Plants." At a previous meeting he showed that extra vigor or vitality was accompanied by a greater cohesion or adnation of the leaves of coniferæ with the stems. Similar laws, it seemed probable, governed the production of the sexes in plants. The female flowers of Norway spruces were always on the most vigorous branches; male flowers only on weak branches. As the strong ones become weak they lose the power of producing females and produce males only. But the Larch afforded the best illustration. As shown last year the most vigorous shoots have the leaves adherent with the stems. What we call leaves are only foliaceous awns. The true leaves only appear when the axial growth is arrested, the verticils or spurs bearing the true leaves. When the reproductive age commences the Larch can only bear flowers from these weakened spurs; only the strongest of these produce female flowers, and only after two or three years of weakening process, by the shade afforded by the increased growth of branches, do the male flowers appear. So low is vitality when these male flowers appear that with their production the whole spur dies. The long, dead, warty strings on Larch shoots are what have been male flowers. The same law can be traced more or less through all *Coniferæ*. In *Amentaceæ* the same law, only in another form, prevails. In *Quercus*, *Juglans*, *Carya*, and others, male flowers appear with the opening leaves of spring, evidently formed during expiring vegetative force the fall before: the female only after growth has grown vigorously on the apex or culmination of the greatest vigor. In *Corylus*, *Carpinus*, and allies, the male flowers were also on the weakest parts. There were in some plants several *waves* of growth in the most

vigorous shoots; for instance *Pinus inops*, *P. pungens*, *P. mitis*, *P. rigida*, and some oaks. In these cases the first wave was the most vigorous, the last the weakest, but the female flowers are not on the apex of the shoot, but on the apex of the *most vigorous wave*. The *Cyperaceæ* afforded similar illustrations. Vigor is only one form of high vitality. Power of endurance is another. The Norway spruces, and those species generally which were the hardiest individually, or in comparison with other species, had greater powers to produce female flowers. Not so easily seen, but yet evident was the law in hermaphrodites as in monœcious plants. In many hermaphrodites there was known a tendency to become unisexual, sometimes in the male, sometimes in the female direction. A general debility follows the male in such cases, and increased vitality the female. *Viola*, *Fragaria*, and other instances were given in favor of the latter point, and double flowers, variegated plants, etc., as instances of degeneracy to male weakness. The conclusion drawn from the facts given was, not to establish the theory, but to excite investigation whether it was not *the highest types of vitality only which take on the female form?* He concluded with the bare suggestion that the same laws might prevail in the animal world.

He also read a paper "On the Nature of the Leaf-glands in *Cassia* and *Acacia*." Dr. Asa Gray says in the fifth edition of the "Manual" that the glands on *Cassia Marilandica* are near the base of the petiole. This is true only of the upper leaves. In the lower the position varies from near the base up to the first pair of leaflets. This shows it is not a part of the leaf system as it then would have its regular position. It *must be an accident*. In a neighboring genus (*Gleditschia*) we find two buds are formed above each leaf; the one axillary, the other just above, and usually forming a stunted branch or spine. The lower bud produces the growing shoot. In another allied genus, *Gymnocladus*, two or *three* buds are formed one above another, very few of which ever push at all, but when this does take place, it is only the *upper bud* which forms a shoot. The *lower bud* is generally about the centre of the dilated base of the petiole. Thus we have a class of allied plants, with two or three buds one above another, in some cases two inclined to push freely, although one as a spine (as in *Gleditschia*), the lower as the shoot; in another, as in *Gymnocladus*, scarcely pushing at all, and rather absorbed by the stem; but when pushing at all, the *upper one*, and on the other side of *Gleditschia*, *Cassia*, *Acacia*, etc., with the lower bud *absorbed by the petiole, and thus forming the gland.*

W. H. Dall read a paper "On the distribution of the native tribes of Alaska, and the adjacent territory." After reviewing the works of Baer, Wrangell and Holmberg, Mr. Dall proposed a new classification, the revision being based on new information obtained during personal exploration by himself and his companions.

The North American natives are divided into two great groups, Indians, and, another for which there being no general term, he proposed

the name Orarians (from *ora*, a coast), in reference to their universal coastwise distribution.

Various points of interest in regard to the several tribes were noted and their comparative relations were shown by a table of twenty-four dialects, and a colored map showing their geographical distribution.

Prof. ALBERT S. BICKMORE read a paper "On the Distribution of Coal, Iron, Mercury, Tin, and the precious metals, in China. Prof. B. show[illegible] that coal occurs from place to place over the whole of China proper, a[illegible] that iron is found in the north of China, especially in the Province [illegible] Shansi, where the ore is obtained from which the steel used in the man[illegible] facture of razors, knives, etc., is made. Mercury, or "Water-silver" [illegible] the Chinese call it, occurs in Shansi in small quantities. Tin is report[illegible] from various localities. Petroleum was not only known but used [illegible] lamps more than 160 years ago. The Chinese name for it, "Oil of Sto[illegible] is identical with ours.

Prof. C. H. HITCHCOCK stated in his paper "On the Ammonoosuc G[illegible] Fields," that this area begins near Bellows' Falls, and extends into C[illegible]ada, following the Merrimac river. It was at first referred to the Que[illegible] group, but he thought the rocks distinct. The gold was found in 1864 [illegible] the rocks, by Mr. Henry Wurtz, at Lima, N. H. The rock is a black [illegible] slate, with quartz veins containing iron pyrites, ankerite and galena.

Dr. C. C. PARRY in his paper "On the Rocky Mountain Alpine Regio[illegible] stated that the wooded belt of coniferous trees begins by a somew[illegible] scattering growth near their base at an average elevation of six th[illegible]sand feet above the sea. This belt acquires its densest growth, and [illegible]hibits the greatest number of distinct species, at an elevation of betwe[illegible] 7000 and 9000 feet, and terminates by an abrupt well marked line at [illegible] average height of 11,500 feet.

The limit of upright tree growth is marked with a singular abrupt[illegible] He explained this by supposing that the so called timber line marks [illegible] extreme point of minimum winter temperature, below which no [illegible] phenogamous vegetation can exist. All that survives above this [illegible] does so by submitting to a winter burial of snow, beneath which [illegible]ing cover it is enabled to maintain its torpid existence. The usu[illegible] acters of alpine plants here as elsewhere exhibited, consist in a dwa[illegible] habit of growth, a late period of flowering, and early seeding, the [illegible] being almost exclusively perennial.

The [illegible] flora is represented by thirty-four natural orders, of w[illegible] thirty [illegible] belong to phenogamous plants, the remaining three [illegible] the higher orders of Cryptogams; of the latter the ferns are represent[illegible] by a single species [illegible] R. Br., not ex[illegible] alpine. Mosses are numerously represented, but are still comparat[illegible] rare, while lichens are most abundant and afford the greatest number [illegible] species.

The alpine area lying between the thirty-seventh and forty-first pa[illegible]allel of [illegible], is from 1200 to 1500 square miles in extent. As a su[illegible]

tary retreat during the summer months it is unexcelled in the purity and coolness of its atmosphere, the clearness of its flowing streams, and its picturesque, extended views.

Prof. E. D. COPE, in his paper "On the Larval Characters of the Urodela," stated: 1st, That it is shown that one portion of the primary groups is inexactly parallel to larvel stages of the other portion. 2d, That certain genera only fail of exact parallelism with larval stages of other genera by but two characters. 3d, That others lack but one character; and 4th, That others present an exact parallelism.

He had reason to think from the development of Amblystoma, and experiments on salamander and frog larvæ, that the process of growth or assumption of generic characters may be much retarded or accelerated. Such a process would produce the cases of exact parallelism; and if the retardation in the character should continue, would necessarily soon result in inexact parallelism in that respect, thus producing a complete metamorphosis of the genus. The reverse of this process is acceleration, and expresses the mode of progress of a type to its highest development in time history, while the retardation is the mode of its degradation.

Mr. HYATT remarked that Prof. Cope's views were, so far as the law of acceleration was concerned, equally good among the shell-covered Cephalopods. Among these animals the shells of the species displayed the action of this law. He quoted from a previous publication in the "Memoirs of the Boston Society of Natural History," in which this law had been distinctly stated. But farther than this that its action was also as forcibly displayed in the species itself as in the genus.

Mr. A. HYATT read a paper "On the Homologies and General Structural Relations of the Polyzoa." The Embryology of the Hypocrepian Polyzoa show that Loxosoma is the lowest of all in the order, and together with Pedicellina form the lowest suborder of the group. The progress of the whole order of Polyzoa is from this permanently invaginated form through intermediate stages to Cristatella, in which, when the polypide is inserted, even the stomach is carried up beyond the orifice of the cell. Thus the progress of structure is from an animal in which all the organs are crowded into the anterior end, into the cœnœcial system, and to one in which the cœnœcial or reproductive, evaginatory or gastric, and the lophoric or neural systems are all distinct when the animal is exserted.

The Polyzoön may be transformed into a Brachiopod by simply enlarging the cœnœcial wall and carrying it over, inclosing the lophophore and reversing the position of the arms. Thus both the Polyzoa and the Brachiopods may be defined as sacs, closed at the posterior end by discs surrounded by tentacles, and perforated by an edentulous mouth, from which hangs the alimentary canal in the antero-posterior axis of the sac. The whole plan of the Mollusca was stated to be that of a simple sac, and the term Saccata proposed as more appropriate than that of Mollusca. The objection that the whole animal kingdom may be said to be sac-like

has been raised. The Radiata are, it is true, radiated sacs, the Art[illegible] ranged sacs, and the Vertebrata sacs divided by the vertebral axis [illegible] the Saccata are typically sacs.

Prof. THEO. GILL, in his communication "On New Species of [illegible] obtained by Prof. Orton in the Valleys of the Marañon, etc.," [illegible] cluded from the study of twenty-five species collected by Prof. [illegible] that there were no distinct fish faunae in these river valleys, species [illegible] same genera having been found distributed through the [illegible] genera having also occurred lower down the Amazon, which [illegible] habited the fresh waters of Central America.

Dr. T. STERRY HUNT, in his remarks "On the Geology of N[illegible] ern America," exhibited a new geological map of the British P[illegible] and of the United States as far South as Virginia, and West [illegible] base of the Rocky Mountains. He called attention to the [illegible] from [illegible] by New England, and to the fact that less was k[illegible] the age of the rocks of that region than any other. He [illegible] knew of [illegible] rocks, but [illegible] they were [illegible] Metamorphism depends [illegible] We cannot [illegible] He [illegible] Devonian sandstones are over[illegible] Devonian sandstones are [illegible]

[illegible]

these rocks lie the granite rock, and there appears to be a gradual passage from true granite, through felsites, to undoubted Upper Devonian slates, these Nerepis granites being probably altered sandstones and grits at the base of the Upper Devonian series. The rocks south of the granite ridge were littoral, and those on the north were deposited in deeper waters, the rocks being much more uniform. In the partially metamorphic slates of the Lepreau division, plants and shells characteristic of the Upper Devonian have been found, and when more highly altered, well defined crystals of staurotide, andalusite and garnet.

Having unexpectedly found that the greater part of the metamorphic country in New Brunswick, near the United States border, is of Upper Devonian age, the authors offered some suggestions and conjectures on the probable age of the schists, granites, etc., in the south-eastern half of Maine.

The granite ridge of southern New Brunswick enters the State of Maine at Calais, and is there represented by a thick body of conglomerate gneiss (composed of dark sienitic pebbles, from two inches to as many feet in diameter, enclosed in a white granitic, often porphyroid matrix), dark sienitic gneiss and white granite, which they believed to be Laurentian, and a mass of red, weathering, coarse granitoid rocks, which may represent those of the Nerepis, and perhaps constitute the basal portion of the Devonian. Both of these are probably represented in the granitic district of south-eastern Maine. To the eastward of this we appear to have chiefly Upper Devonian rocks, with occasional bands of upturned Upper Silurian rocks. The "traps" of this area correspond to the diorites, etc., at the base of the Mispeck division, and the red jasper to the red felsites and orthophyre above them. It is probable that the Lepreau divisions will be but meagrely represented, and the upper half of the Mispeck wanting in this tract, such being the case around the Passamaquoddy Bay.

On the north-west side of the granite ridge noted, we again meet in New Brunswick the Upper Devonian slates, now in their pelagic aspect. On the Maine border above Baring these consist of finer gneiss and micaceous quartzite, the former dipping towards and abruptly meeting the gneiss conglomerate, above alluded to, within which, along the line of junction, small pieces of the Devonian gneiss are imbedded, as though fragments of the latter had sunk in the pasty mass. Farther north these Devonian beds are folded and dip northward, passing beneath a heavy body of fine greenish and grayish micaceous slates, which here represent the Cordaite shales, or Lower Mispeck beds.

A similar arrangement is indicated by Prof. Hitchcock, who represents the slates or schists north of Baring as lying in a basin between the granite ridge above named, and another which crosses the northern part of Washington County and is supposed to connect through the northern part of Hancock County with the granitic masses around Mount Desert on the coast. On the southern side of this last granitic ridge, and form-

ing the northern side of the trough, are a series of beds described as quartz rock and calciferous mica schist, and which are said to be the same as those known to extend through York County, N. B., towards the Bay de Chaleur. This belt of rocks has been recognized, with essentially the same features, by Mr. Bailey on the St. John River above Fredericton, and about Grand Lake in the eastern Schoodic region in Maine.

The granites on the north side of this basin are overlaid by a gray gneiss holding bands of micaceous quartzite, which constitute the first rocks seen on the northern slope of the granitic mass. These may be the "argillo-micaceous schists," described by Prof. Hitchcock as holding a similar position in Maine and which are said to extend in an "essentially unaltered form to the Saco River."—in fact nearly reaching the south-west corner of the State. At this end of the basin, where probably the lower beds are exposed, the rock contains garnets, staurotide and kyanite. Along the north-east side (in Northport) it holds andalusite. If these rocks represent here the Lower Lepreau series, as the mica schists, holding a similar position and containing the same minerals, do in the central parts of Charlotte County, the geology of this portion of the Province will be greatly simplified.

There is a belt of granite associated with masses of obscurely stratified gneiss and beds of pyritiferous mica-schist extending along the Coast of Maine from Portland eastwards to the mouth of the Penobscot River, which, as described in Prof. Hitchcock's Report, resembles the Laurentian series of New Brunswick. With this exception, and possibly that of the belt of slates and quartzites which skirts the southern edge of the northern granite belt, nearly all the formations of south-eastern Maine might, on lithological grounds, be compared with those of the Upper Devonian series. Among these, however, may be islands or ridges of older rock, as is probably the case at some points along the eastern border.

PROF. E. D. COPE, read a paper "On two New Genera of Extinct Cetacea." His observations embraced a description of the characters of a very large representative of the Dugong of the modern East Indian Seas, which was found in a bed, either Miocene, or Eocene, in New Jersey. It was double the size of the existing Dugong, and was interesting as adding to the series of Asiatic and African forms characteristic of American Miocenes. Another type was regarded as remotely allied to Squalodon, but it was edentulous, and furnished with a broad shallow alveolus, either of a form left after shedding a tooth, or that adapted to a broad obtuse tooth. It constituted a remarkable new genus which was called *Anoplonassa forcipata*. It was found in post pliocene beds near Savannah. He also exhibited teeth of two gigantic species of Chinchilla which had been discovered in the small West India island of Anguilla, which has an area of about thirty square miles. The specimens were taken from caves and were thought to indicate post pliocene age. With them was discovered an implement of human manufacture, a chisel made from the lips of a shell, *Strombus gigas*. The contemporaneity of the fossils and human

implements was supposed, but not ascertained. Its interest and connection with human migrations were mentioned; also the supposition of Pomel, that the submergence of the West India Islands took place since the post pliocene period.

Prof. O. C. Marsh described a "remarkable locality of Vertebrate remains in the tertiary of Nebraska." The locality described was the Antelope Station on the Pacific Railroad in South-western Nebraska. While engaged in sinking a well at that place in June, 1868, a layer of bones was found by the workmen at a depth of sixty-eight feet below the surface, which were at first pronounced to be human, but, during a trip to the Rocky Mountains, Prof. Marsh examined the locality and the bones, and found that the latter were the remains of tertiary animals, some of which were of great interest. The well was subsequently sunk about ten feet deeper. An examination proved that among them there were four kinds of fossil horses, one of which he described in November last as *Equus parvulus*. Although it was a full-grown animal it was not more than two and one-half feet high. It was by far the smallest horse ever discovered. Of the other kind of fossil horses one was of the Hipparion type, or the three-toed horse. Including the above the number of species of fossil horses discovered in this country was seventeen, although the horse was supposed to be a native only of the old world, and was first introduced here by the Spaniards. Of the other remains there were two carnivorous animals, one about the size of a lynx and the other considerably larger than a lion—twice as large as any extinct carnivora yet discovered in this country. Among the ruminants found in this locality was one with a double metatarsal bone, a peculiar type, only seen in the living musk deer and in the extinct anaplotherium. There were also the remains of an animal like the hog, a large rhinoceros, and two kinds of turtles. These, together, forming fifteen species of animals, and representing eleven genera, were all found in a space ten feet in diameter and six or eight feet in depth. It is supposed that the locality was once the shores of a great lake, and that the animals were mired when they went down to the water to drink.

Prof. W. P. Blake read a paper "On the Plasticity of Pebbles and Rocks." He presented some fresh evidence from a conglomerate in Arizona Territory. This conglomerate consisted of a paste of micaceous schist, filled with pebbles of varying size, and elongated and compressed similar to those of the Newport conglomerate. They presented even more conclusive evidence of having been drawn out, and compressed by tension and enormous pressure, than even the Newport pebbles. Eminent geologists had alleged that deep seated rocks often became plastic and that those not much exposed to air were softer than those on the surface. Prof. Blake then adduced arguments and facts tending to substantiate this theory. The distortion of hard rocks was found on a large scale in the flanks of the Sierra Nevada of California. Prof. Blake said that the consideration of the phenomena led him to conclude that enormous and long

continued pressure and tension probably at a moderate [illegible] perature but not necessarily so had been sufficient to [illegible] cular movement of these [illegible] and apparently [illegible] Mechanical force alone appeared to have been the agent [illegible] had shown that under enormous pressure solids [illegible] the same manner as liquids, or that [illegible] same law. By the careful study of these phenomena [illegible] views were opened of the structure of [illegible] rocks [illegible] mena of [illegible], [illegible], and of the [illegible] of [illegible] veins and [illegible] enclosing [illegible] facts. Prof. [illegible] thought that geologists should [illegible] changes [illegible] been produced in the [illegible] mechanical pressure [illegible] extraordinary [illegible]

Prof. O. C. Marsh [illegible] M[illegible] from [illegible] of N[illegible] [illegible]

[illegible]

In the report of his explorations in California and Oregon, Prof. Newberry had described these lacustrine deposits and had shown how the lakes at the bottom of which they accumulated had disappeared by the cutting down of their outlets, the gorges through which the Columbia, Klamath and Pitt Rivers now flow.

The Klamath lakes, etc., were miniature representatives of these ancient lakes which were apparently quite as extensive as our present great lakes. The fossil plants contained in the collection made by Rev. Mr. Condon were most beautifully preserved, and consisted of a great number of species, most of which were new; but a number were identical with species found in the Miocene Tertiary of the Upper Missouri. There are also some species which had been found in the Miocene beds of Frazer's River and Greenland. The present collection will add much to our knowledge of the Flora of the Miocene period on this continent. The animal remains found in the same series of Tertiaries with the plants, consist of fresh-water shells and fishes, with a few mammalian bones. The shells are numerous species of *Melania*, *Planorbis*, *Corbicula* and *Unio* — all, so far as known, new to science. The fishes were Cyprinoids allied to *Mylopharodon*, etc., — the fishes now inhabiting the Western rivers. Among the mammalian bones contained in this collection were some that plainly belonged to the horse. The beds containing the animal remains were perhaps more recent than the plant beds, but still Tertiary.

Mr. W. H. Dall read a paper "On the Trend of the Rocky Mountain Range, north latitude 60°, and its influence on Faunal Distribution." The paper stated that the Rocky Mountain Range, between latitudes 60° and 64°, bends trending with the Eastern coast, so that instead of there being, as represented on the old maps, a straight line of mountains up to the Arctic Sea, there is an elevated plateau, only broken occasionally by a few ranges of hills. This bend of the mountains prevented the characteristic birds of the west coast from coming north, while a few species of Eastern birds came clear to Behring's Sea, north of it, over the plateau. He also stated that the elevation of the bottom of Behring's Straits one hundred and eighty feet would make dry land between Asia and America, but that a deep ocean valley extended south-west from Plover Bay, just west of the Straits, along the Kamtchatka Coast.

Dedication of the Museum of the Peabody Academy. — On the eighteenth of August, being the first day of the session of the American Association, the Museum of the Peabody Academy was formally dedicated, and it seemed peculiarly fitting that the exercises should take place in connection with the meeting of the American Association, which adjourned over in order that the members should participate in the proceedings.

At 2 P.M. a number of friends of Science met at the Museum, when a formal transfer of the building was made by the Committee of the Trustees of the original fund, to the Trustees of the Academy, and the charge of the Museum committed to the Director, Mr. F. W. Putnam. The audience then repaired to the Tabernacle Church to listen to the Dedicatory

Address by the President, W. C. Endicott, Esq. Hon. J. H. Clifford replied on the part of Mr. Peabody, the founder of the Academy, who was unfortunately absent from the ceremonies owing to his continued ill health. Remarks were made by Mayor Cogswell; B. H. Silsbee, the President of the East India Marine Society; Henry Wheatland, President of the Institute, and by J. W. Foster, President of the American Association for the Advancement of Science.

ANSWERS TO CORRESPONDENTS.

W. W. B., Indianapolis, Ind.—Your specimens are as follows: 2, *Onoclea sensibilis*; barren frond, common at the north and south. 3, *Pteris aquilina*; widely distributed. 4, *Asplenium thelypteroides*; found north and south. 5, a species of *Galium*. 6, *Eleocharis olivacea* Torrey. 7, no fruit, and not easily determined. If you mean by the "Snow-plant" *Sarcodes sanguinea*, you will not be able to cultivate it, as it is parasitical in its habits and proves very difficult to rear. Herbariums are not usually published unless of rare and costly character, such as of newly discovered species like Fendler's of Venezuela, Wright's of Cuba, etc.—J. L. R.

H., Danversport, Mass.—The worm declared by your patient to have been found in the wound is a worm allied to the common earthworm, and probably lived in the muddy bottom of a well, spring, or brook, and may possibly have occurred in the water used in dressings. We have kept it alive in the bottle in which you brought it, for four or five days.

W. W. B., Indianapolis.—No. 8 is *Botrychium lunaroides* var. *obliquum*; barren frond. Hooker's Synopsis Filicum, and Presl's Pteridigraphia, are essential in studying the ferns extensively.—J. L. R.

W. C. F., Eastham, Mass.—The frog is *Rana sylvatica*.

EXPLANATION OF PLATE 7.

RADIOLARIA.—Fig. 1. Tetrapyle octacantha. Fig. 2. Haliomma amphidiscus. 3. Haliomma longispinum. 4. Haliomma hexacanthum. 5. Haliomma Humboldtii.

BOOKS RECEIVED.

Scientific Opinion. June, July, Aug., Sept. London.

Journal of Travel and Natural History. Vol. 1, No. 6. 1869. London. Two shillings.

Proceedings and Transactions of the Nova Scotian Institute of Natural Science at Halifax, N. S. Vol. ii, Part 2. 1867–8. 8vo. Halifax, 1869.

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Pathogenesis of Ptelea trifoliata; a Report to the American Institute of Homœopathy. By E. M. Hale, M. D. Boston, 1869. 8vo, pp. 85.

American Journal of Numismatics. July. New York.

Library of Education, selected from the best writers of all countries. Scottish University Addresses. By J. S. Mill, Jas. Froude, and T. Carlyle. New York: J. W. Schermerhorn & Co. July, 1869. 32mo, pp. 192. 20 cents.

CORRECTIONS.

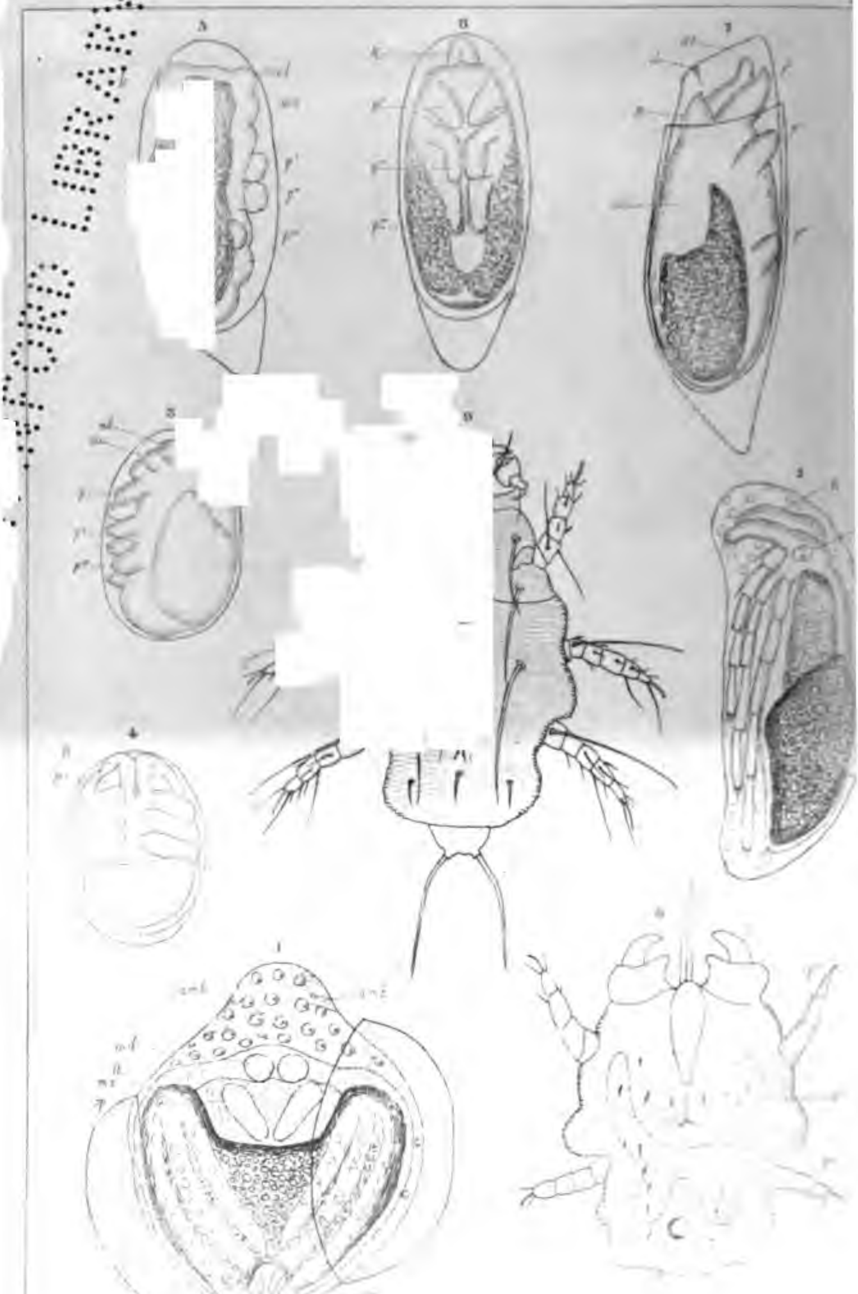
In our September number, in the "Chapter on Mites," we suggested that Plate 7, fig. 1, represented the larva of *Dermaleichus*, and that fig. 3 represented the male. We were led to this opinion by the resemblance of fig. 1 to fig. 4, the larva of another genus of mites. After the article went to press we obtained the elaborate memoir of Claparède, entitled "*Studien an Acariden*" published in a recent number of Siebold and Kölliker's "Zeitschrift" where he has given a minute account of a neighboring genus, *Myocoptes musculinus* (Koch) found parasitic on mice. After studying Claparède's work we judge that our figure 1 must be a female Dermaleichus, and that fig. 3 represents the male, and fig. 2 the young male.—A. S. P.

On page 368, line 2 from bottom, and on page 373 line 10 from top, for Chelytus *read* Cheyletus. Page 316 line 20 from top, for Euglenia *read* Euglena.

On page 331, line 6 from bottom, for Orange, N. J. *read* Orange, N. Y.

On page 326, line 1 from the bottom, for "Mission County," *read* Mifflin County, Pa.

The author of the article on "Table-mountain Pine" (J. T. Rothrock) also states that Mr. Meehan has since found the same pine on the hills near Harrisburg, Pa., and concludes it is native to the whole interior of the State of Pennsylvania. (See Gardener's Monthly, June, 1867, p. 173.)



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SPONGES.

BY BRYCE M. WRIGHT, JR.

Do sponges belong to the animal or vegetable kingdom seems to be the first question which presents itself to our mind in investigating these curious organisms, and this question involves a definition of a boundary line between the two kingdoms, which, of all the most perplexing queries that can be found for an unlucky naturalist, perhaps is the most difficult. Eminent zoölogists have, at various times, ranked them as belonging to the class of Zoöphyta, but others equally clever have disputed this right, and have claimed them as belonging to the vegetable kingdom. In the celebrated work of Dr. Johnston on British Zoöphyta, he disposes of them in a very summary manner. The following extract deserves attention: "if they are not the production of polypes, the zoölogist who retains them in his province must contend that they are individually animals, an opinion to which I cannot assent seeing that they have no animal structure or individual organs, and exhibit no one function usually supposed to be characteristic of the animal kingdom. Like vegetables they are permanently fixed; like vegetables they are non-irresistible; their movements, like those of vegetables, are extrinsical and involuntary;

their nutriment is elaborated in no appropriated digestive sac, and, like cryptogamous vegetables or algæ, they usually ramify and grow in forms determined by local circumstances, and if they present some peculiarities in the mode of the imbibition of their food, and in their secretions, yet even in these they evince a nearer affinity to plants than to any animal whatever." This argument is certainly very favorable to their classification with plants, but there are other arguments by zoölogists equally clever in favor of their classification with animals. Linnæus seems to have changed his opinion several times respecting them. In the commencement of his great work he considered them as plants, or at all events as very doubtful animals; but in a later edition of his "Systema Naturæ," he seems to have admitted them along with the zoöphytes in the animal kingdom. In the opinion of Pallas, deBlainville, and others, they are intermediate organized bodies, without any determinate form, and with little susceptibility of feeling, but presenting an absorbent surface, and nourished pretty nearly like vegetables by the surrounding medium.*

Sponges consist of a framework, or skeleton, coated with gelatinous matter, and forming a non-irritable mass, which is connected internally with canals of various sizes. The ova are very numerous, and present in appearance the form of irregular shaped granules derived from the gelatinous matter, which grow into ciliated germs and falling at maturity into the small canals, are then expelled by the orifices. When alive the body is covered by a gelatinous film, which, being provided with cilia causes a current of water to pass in at the smaller pores and out at the larger apertures, the sponge probably assimilating the nutritive particles which enter into the water. Papers have been written from time to time endeavoring to prove that the pores palpitate, but this has been stoutly denied, and perhaps the cause of their

* The sponges are, by the most advanced zoölogists, considered to be undoubtedly animals; all botanists reject them from the vegetable kingdom.— *Editors.*

being moved in such a manner as to give rise to this discussion is in consequence of the action of the water in passing through them. According to the analysis of sponges by Hornemann, they consist of a substance "similar to osmazone, animal mucus, fat oil, a substance soluble in water, a substance only soluble in potash, and traces of chloride of sodium, iodine, sulphur, phosphate of lime (?), silica, alumina, and magnesia." The quantity of silica which constitutes the structure of sponges is remarkable. It generally occurs in the form of spiculæ in considerable quantities, embedded in the substance or body of the sponge. In the species of Halichondria, the silicious spiculæ are pointed at the extremities, whilst the spiculæ of some are pointed at one end only, and are round at the other; sometimes they appear cylindrical, curved, or straight. The spiculæ of the genus Pachymatisma are often sharp at one extremity and at the other expand into two points; some are sharp at one end and expand at the other into three points; the *P. Johnstoniæ* can be taken as an example of the latter. The genus Tethea possess silicious spiculæ having hooks at both ends, and amongst the genera Grantia, Geodia, and in the Levant Sponge, the spiculæ are very large and radiate into three directions like a three pointed star. When properly mounted they form very beautiful microscopic objects. The spiculæ of the *Grantia nivea* show them to be of the triradiate, or three pointed, star shape, those of the *Halichondria Griffithii* in the form of pins, whilst those of the common sponge, from the Philippine Islands, are sometimes in the shape of crutches or stars. In the common Madrepore Sponge (*Dactylochalix pumicea*) the silicious element is fully developed as the whole mass is composed of this extremely hard substance, which is disposed in tubular and radiating canals. One of the rarest, and I may say most beautiful of the silicious sponges, is the *Euplectella** *speciosa* Gray (Fig. 76). It is described in the "Transactions of the Zoölogical Society

* *Eu*, well; and *pleko*, I weave.

Fig. 76.

of London," by Prof. Owen, as the *Euplectella aspergillum*, from the fact of its being in shape like the common *Aspergillum Javanicum* of Java. "Mr. Cuming" says Prof. Owen "has entrusted to me for description one of the most singular and beautiful as well as the rarest of the marine productions, with which his researches in the Philippine Islands have enabled him to enrich the zoölogical collections of his native country." The first specimen of this remarkable sponge was purchased by Mr. Cuming, the celebrated conchologist, at the death of Mr. William J. Broderip, who had formerly given the sum of £30 to become the possessor of this then unique Euplectella. This specimen, the only one known for a great many years, is now in the possession of the authorities of the British Museum in England, by whom it is greatly prized in consequence of its possessing the gelatinous film in its natural state. It certainly is one of the most curious and extraordinary combinations of fibrous and silicious structure which the bed of the ocean has ever yielded up to the researches of the naturalist. It differs materially from any sponges with which we are acquainted, being regular in its form. It is of cornucopia shape, and has a horny skeleton-like network, composed of large silicious fibres running from the base to the head, surrounded by smaller fibres, forming square open meshes resembling a net or basket-work. It ranges in height from six to even fifteen inches. At the lower extremity, or root, it averages about an inch in thickness, but its size gradually increases as it approaches the top, where often it is two inches wide. It is surmounted by a ridge about quarter of an inch wide, and is closed at the larger extremity by a delicate open lace work of fibres possessing no particular pattern. It is on this light and pretty structure that the fibrous gelatinous substance rests, resembling in texture the common sponge, but in this instance disposed in an irregular foliated pattern, over which the usual film of the sponge is laid during life. The base or root attaches itself to almost anything which may serve as a sup-

port; some being fixed to rocks, others to shells, and indeed any submarine objects which may present a surface strong enough to answer the purpose required. It is remarkable, but nearly all the specimens I have examined of this sponge have had enclosed in them a common hermit or soldier-crab. How this pugnacious member of the crustacean class becomes imprisoned it is difficult to conceive. Dr. Gray, of the British Museum, in speaking of them in "Land and Water," a London periodical, says that "the natives of the Philippine Islands deny that they are sponges, but say that they are formed by the crabs that are usually found in them, and that a pair of crabs form two close together. Hence they regard two specimens, as we should call them, a single individual." They consist of pure silica, and Mr. C. G. Brewster, naturalist, Boston, to whose courtesy I am indebted for the accompanying faithful engraving, has several specimens which, having lost their outer covering or film, have been cleaned by being placed in a weak solution of chloride of lime, and afterwards exposed to the action of the atmosphere. The Euplectella is found principally near the island of Zebu, one of the Philippine's, where the first specimen was obtained by the late Hugh Cuming.

The forms of sponges are very irregular, some being branched, others round or pear-shaped, and others resembling a cup, like the well known "Neptune's cup" of the Indian Seas. During life they are extremely beautiful in colors, possessing tints which it would be impossible to describe, and which I do not think have ever been faithfully represented in consequence of their beauty departing immediately after life ceases. Dr. Johnson states that the green color of the fresh-water sponge (*Spongilla fluviatilis*) depends upon the action of light, as he has proved by experiments which showed that "pale-colored specimens became green when they were exposed for a few days to the light and full rays of the sun; while on the contrary, green specimens were blanched by being made to grow in darkness or

shade. All sponges are aquatic, and with few exceptions marine. They attach themselves to all manner of objects which may present a point of support, whether floating or fixed; some select their abode on very unexpected objects. In one case recorded in the "Natural History of British Sponges," by Dr. Johnson, a specimen belonging to the genus Halichondria, a sponge not uncommonly found on some of our coasts, was discovered growing from the back of a small live crab,—"a burden" says the learned Doctor, "apparently as disproportionate as was that of Atlas,—and yet the creature has been seemingly little inconvenienced with its arboreous excrescence." The fresh-water sponge (*Alcyonella stagnorum*) is frequently to be met with floating in docks attached to logs of timber. It is very interesting to observe that these low organisms even seem to be attracted to each other, as it were in family groups. The *Alcyonellæ* live in groups of from ten to fifteen, and some sponges are so intimately connected as to be inseparable. Respecting their geographical distribution they are to be met with in all seas, and although they abound to a much greater extent in the tropics, even on the coast of Great Britain a great many species occur, nearly forty having been reckoned to belong to one genus alone.

RAMBLES IN FLORIDA.

BY R. E. C. STEARNS.

PART IV.

It was nearly noon of a delightful day in February when leaving the City of Tampa we crossed the Hillsborough River to the opposite bank for the purpose of visiting Rocky Point, which is situated upon *old* Tampa Bay; the route, for the greater part of the distance of seven miles, is through an

open forest of pines, of the species previously met with; the lack of undergrowth afforded pleasant and shaded vistas in every direction. In following the sandy road we waded through broad and shallow pools, miniature lakes made by the recent rains, in which we dipped our cans, and drinking found it more palatable than the water from the muddy springs we had just passed.

Upon both sides of, and a few rods from, the road are small deep ponds, covering perhaps an acre, surrounded with gaunt and leafless cypresses, *Taxodium distichum*, standing grim and naked in the midst of the forest; hoary, speechless giants, whose gnarled limbs seem to clutch at, while they sustain long drooping tufts of pendulous moss, that, in the sombre light, looked more like funeral emblems than living vegetation. Over these glassy lakelets the

> " * * * towering boughs of the cypress
> Met in a dusky arch, and trailing mosses in mid air
> Waved like banners that hang on the walls of ancient cathedrals.
> Death-like the silence seemed, and unbroken save by the herons,"

many specimens of various species of which were seen slowly marching with solemn strides, like veteran soldiers, guarding the solitude of the forest.

Seating ourselves upon a fallen pine we halted to rest awhile, for walking is warm work on such a day. There are no wild flowers, and in many places no grass, for a fire, which the last rain only partially extinguished, burned even the scanty sod.

Again we started, and moving forward had proceeded but a few rods when up flew a wild turkey (*Meleagris gallo-pavo* Linn.), the only specimen yet met with by us in Florida, and farther on, but out of range, a flock of quails, *Ortyx Virginianus*. This species is quite pretty; in fact all of the quails are tidy-looking birds, but the Californians,* with their plumed heads, rather lead the others.

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* *O. pictus* Baird, and *Lophortyx Californicus* of Bonaparte, are common in the game season in the San Francisco markets, especially the latter species. They have, of late years, become more plentiful in California, though previously quite abundant. Their

The small hillocks of sand, of which we have seen at least a hundred since we left Tampa, are made by a species of Gopher (*Geomys pinetus* Raf.). The people call them Salamanders. The propriety of the name is not perceptible. Three or four species of *Geomys* are found in the Pacific States.*

We have arrived at the edge of the timber; the road no further winds beneath the shade of the forest, but lies broadly open to a burning sun. It follows for a short distance through a sedgy marsh, with a rank growth upon either side and terminates at a cluster of cabins, which stand upon the sandy margin of the bay.

The small rudely thatched buildings, are occupied by a number of workmen engaged in the manufacture of salt. Their apparatus is of the simplest description. It consists of a few kettles, or evaporators, made by cutting in halves, longitudinally, the shells or outer cylinders of small steam boilers, which are rudely set in masonry of stone and mud. Into these kettles the salt water is pumped by hand from a well-hole, a large pit dug in the sand, into which the water seeps, or flows. The evaporation is produced by means of a fire under the kettles; the inflammable pitch-pine making an admirable fuel for this purpose. The thatched cabins† of the salt makers were quite a novelty to us. They are fifteen to

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increase is owing to two causes: the game-laws of the State protect them during the breeding season, and the extended settlement of the agricultural lands, leads to the extermination of those animals that prey upon them.

*The Gophers make sad havoc in the suburbs of San Francisco, by cutting off the roots of rare plants in the flower beds, or by gnawing through the cabbage roots in the market gardens. As they work underground, they are not easily detected, though mercilessly hunted upon some occasions by the gardeners, who frequently use a trap to catch them. The Gophers have a pouch in each cheek, in which they can carry food to their burrows.

In an article entitled "South-Western Slang," published in the "Overland Monthly," Vol. III, p. 129, the writer says, "On account of the great number of Gophers in that State, and the former use of their skins for money, a Floridian is called a "Gopher."

In California, a man who practices deception, or acts in an underhanded manner, is sometimes called a "gophering fellow."

†These palmetto structures resemble the thatched cabins of the natives upon the Isthmus of Darien, which are seen by the traveller while crossing from Aspinwall to Panama.

twenty feet square, and about six feet high at the eaves, and the roof is sharply pitched so as to shed the rain rapidly. The frame is made of small poles or saplings, upon which the leaves of the palmetto are tacked or tied, course after course, overlapped like shingles or weather-boards upon a common house. Sometimes a floor is laid and a board door hung to the frame. An excellent shelter for a warm climate is thus made, sufficiently close for protection against ordinary storms, a good screen from the sun, and open enough to admit of ventilation. Exceeding caution in the use of fire is requisite, and cooking must be done outside, and at some distance away.

We were kindly furnished with food and lodging by our host, an old Scotch sailor, with a bushy beard which rivalled the Spanish moss in color and in length:

> "Like a wolf's was his shaggy head,
> His teeth as large and white;
> His beard of gray and russet blended;
> On his hairy arm imprinted
> Was an anchor, azure tinted."

After boxing around the globe for a quarter of a century he finally drifted into this out-of-the-way corner of the planet. With a palmetto cabin, plenty of oysters, game and fish, he lives a free and easy life, with few luxuries and fewer cares: his gun and dog, his boat and fishing gear, supply both food and recreation; like most sailors and sportsmen, he is a good cook; as to his knowledge of the culinary art, inquiry is best answered by the repeated sorties made by us upon the well cooked rations. "Actions speak louder than words."

From the salt works a trail leads across the sands, then through a bit of trampled marsh, over the sands again to shell-heaps large and small. There is only one of the heaps of sufficient size to be dignified by the name of mound; this latter covers an area of half an acre and is fifteen feet in height, at the highest point; it is composed entirely of shells; and the mound and heaps and ridges of shell, are,

perhaps, the remains of many feasts here enjoyed and celebrated by the tribe of which Hirrihigua * was chief. From a well-hole that was dug to the depth of eight feet in the principal heap, arrowheads of chalcedony, a sinker of "coral stone," and a spoon-shaped implement † made from a piece of a large conch-shell, *Busycon perversum*, were obtained. Fourteen species of shells were collected of which nine are the same as found at the Cedar Keys Mounds, and include the species that are living most abundantly at the present day, and which were generally sought for as food by the aboriginees; the other five species ‡ are small shells, too small to be collected for the above purpose and were probably carried to the heaps, from their being attached to the shells of the edible mollusks. No fragments of pottery were detected, and nothing to indicate that the mound or any of the heaps were used for burial purposes; the ground outline of this series of heaps is quite irregular, and it appears rather to have been the result of accident than in conformity to any plan.

From the shell-heaps to the end of Rocky Point is at least a mile; the road or trail follows along the ridge, which consists of beach rubble and debris upon the top of an ancient coral reef; at many places as well as at the end of the point, the coral-rock crops out, and in some localities it is daily washed by the tide; at the water's edge are mangroves, and along the sides of the ridge are pines, palmettoes,§ and but-

* Irving's Conquest of Florida, Ed. 1869, p. 59.

† In the Ethnological department of the Smithsonian Institution may be seen (S. I. No. 5036) an implement from Chattanooga, Tennessee, collected by Mr. McRead, of the same form, and made of a piece of shell of apparently the same species.

‡ One of these species, *Marginella conoidalis* Kiener, is quite numerous in Tampa Bay. I am inclined to believe that the so-called pearls that were seen by DeSoto and his men consisted in part of these shells; a bushel of the shells of this species in one pile was found at a depth of several feet below the surface, in the city of St. Louis, by Mr. T. T. Richards, specimens of which are in the collection of the Peabody Academy of Science. The locality was without doubt the site of an old Indian camping-ground or burial place.

§ "This palm possesses a great, and to this country, an increasing value. It is the only tree produced in our forests which is not attacked by the *teredo navalis*, or ship worm, and as it is incorruptible in salt water, its value for submarine construction is almost incalculable; its leaves can be employed in the manufacture of hats, baskets,

tonwoods, and specimens of the Spanish bayonet (*Yucca*) trees frequently occur. Logs of the Pencil Cedar, that have drifted away from rafts, are lodged along the shore, or have been carried higher up by wind and tide; we turned many of them over and found numerous fine specimens of snails, *Helix volvoxis* and *Helicina orbiculata*, and a living scorpion. The spaces between the roots of the mangroves were filled with oysters which had also fastened to the roots, and a species of *Modiola*, closely resembling the common one, of the Atlantic coast, *M. plicatula*, but with somewhat finer sculpture, was abundant. The small oysters that are so common everywhere along the shore, growing near the high-water line, are not generally eaten except by the raccoons, hence the common name for them of "coon oysters." On the under side of detached lumps of these we found many rare little shells,* and several of the larger species of mollusks† especially the thorny conch, *Melongena corona*, may be seen prowling around, or half buried in the sand, at the edges of the oyster bars. The last named species is a famous oyster eater; but the law of compensation here intervenes, for the animal of the thorny conch is in turn eaten by many kinds of fish, for which it is an excellent bait, and it is therefore much used by the fishermen; the gulf trout also collect them on their own account, and it is quite common to find large shells of this species in their stomachs.

The position of the sun told us that it was time to return; the heat was excessive, and constant tramping and stooping had made us tired.

Cutting a bunch of palmetto leaves to use as a screen for our heads we struck a bee-line back to the shell-heaps; half

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mats, and many other purposes of domestic economy, and the 'cabbage,' composed of the unexpanded embryo leaves may be classed among the delicious vegetables of our table; it is, however, a wasteful luxury as the tree always perishes when deprived of this part of its foliage." Elliott's Botany, vol. 1, p. 432.

*A new species of *Pedipes*, a tiny shell only eleven hundredths of an inch in length, was found at Rocky Point; it is described by me in the Proceedings of the Boston Society of Natural History, vol. xiii, as *P. naticoides*; it is the first of the genus found on the eastern side of this continent.

† *Fasciolaria distans*, *Busycon perversum*; the latter not numerous at this place.

way between the latter and the point, there is a narrow lagoon with dead mangroves standing along its edge; here we found the screw-shaped shell, *Cerithidea scalariformis*,* and the fine *Littorina angulifera* †, the latter on the mangroves high above the reach of the water; and on the grass, or slowly creeping on the surface of the wet sand, the coffee shell, *Melampus coffea*.‡ The Cerithidea is also found near the salt works, and *Littorina irrorata* can be gathered in quantities within a stone's throw of the buildings. On our way across the sand from the shell-heaps, an army of fiddler crabs hobbled aside, opening ranks to let us pass. After a hearty dinner we bade "ye ancient mariner" farewell, and making a straight wake, were at camp by dusk.

Remaining in Tampa for a few days awaiting the arrival of letters, and to complete our reconnoissance of the country in the immediate vicinity, we finally abandoned our headquarters, and bidding adieu to Camp Misery and its numberless fleas we placed our equipment on board of the schooner "Santa Maria, of St. Marks," a vessel of sixteen tons measurement, and cast loose from the wharf at Tampa at noon of a pleasant Monday in February, en route for Cedar Keys, to stop at such islands and points on the way as might be of interest. Proceeding down the bay we anchored near Ballast Point, and grappled up a goodly supply of oysters for the subsistence department, at the same time adding two

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* A much larger (allied) species, *Pyrazus palustris*, which occurs in great numbers in the salt marshes of the Eastern Archipelago, is collected, and the animal eaten by the natives, who roast them and suck the contents of the shell through an aperture made by breaking off the apex of the spire. Vide H. & A. Adams, Genera of Recent Mollusca, Vol. I, p. 291.

† A species of Littorina, *L. obesa*, is used as an ornament by the natives of the South Sea Islands, and the animal of another species (*Littorina litorea* Linn.) is extensively used for food by the poor in Great Britain; thousahds of bushels are annually collected for this purpose.

‡ A species of Melampus, *M. luteus*, is sometimes used to ornament the person by the natives of the Indo Pacific Islands, where this shell is found. In the Ethnological collection of the Museum of the Smithsonian Institution is a specimen (S. I. No. 3663) of a necklace from the King's Mill Islands, collected by the Exploring Expedition under Commodore Wilkes, which is made by weaving or winding eight rows of these shells around a central cord.

species of shells* to our collection, which were found adhering† to the oysters.

From Ballast Point a few hours sail in a light breeze brought us to Piney Point, or Point Pinalles, the latter being the common name with the people here. Off this point there is comparatively deep water and a fair harbor; this place is believed by many to have been the anchorage ground of De Soto's‡ fleet, three hundred and thirty years ago.

The historian says: "His squadron consisted of eight large vessels, a caravel and two brigantines, all freighted with ample means of conquest and colonization;§ besides the ship's crew his force numbered one thousand men with three hundred and fifty horses."

The fleet arrived at the mouth of Tampa Bay on Whitsunday, the twenty-fifth day of May, 1539; three hundred of his men disembarked on the following Saturday, and the remainder of the force landed on the succeeding day.

To the bay, De Soto gave the name of Espiritu Santo; the first detachment met with a rough reception, for on the morning after it landed the savages broke upon the Spaniards who were carelessly lying around, and with deafening yells drove them in confusion to the water's edge; the latter were speedily reinforced from the vessels and soon dispersed their foes.

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* *Mytilus hamatus* Say, and *Odostomia impressa* Say.

† Memorandum for young collectors; always examine critically the outside of large or roughly sculptured shells, for by so doing many rare and valuable acquisitions are sometimes made; many of the smaller species can be obtained in no other way.

‡ After the failure of the Expedition of Pamphilo de Narvaer, Fernando de Soto next attempted to occupy the country, having sold his claims on the Peruvian Conquest in which he performed a prominent part, for an immense sum of money. This last expedition was undertaken by De Soto at his own expense. Landing on the shore of Tampa Bay with one thousand men, and assisted by Ortez, a survivor of the Narvaez Expedition, who was a favorite with a chief in the interior, he proceeded for some distance without serious opposition, treating the natives generally with kindness. He pursued his way through Florida, though bravely and powerfully resisted; after leaving what is now known as Florida, he met with and repulsed several bands of hostile Indians, and was ambushed by a numerous body which he defeated in a desperate conflict; led on by the hope of finding gold, he and the remnants of his army crossed the Cumberland Mountains and the Mississippi River, and it is supposed that he was in the neighborhood of the Red River in Arkansas, when, in the spring of the year 1542, he died of fever at the age of forty-two years.

§ Irving's Conquest of Florida, Ed. 1869, p, 56.

At Piney Point are numerous shell-heaps and mounds; they are covered with a dense vegetation; climbing over prostrate trees, or crawling upon hands and knees, through a tangled growth of vines and shrubs, we forced our way as best we could, from mound to mound, over ground rich with historic interest and upon a spot which had received the footprints of as brave and adventurous a band of men as have ever walked the earth. "If at times our feelings revolt at the outrages committed by them upon the poor Indians, and by their wrongs towards those native chieftains who fought and fell so heroically in the defence of their homes, yet our indignation passes away and is forgotten in the melancholy fate of the invaders. Scarce three years had elapsed from the time of their embarkation at Cuba, when nearly the whole train of youthful cavaliers had passed away; horse and rider alike had perished, and their bones lay bleaching midst the savage wilds of America!"*

The mounds are crowned with magnificent specimens of the palmetto; in the vicinity may be seen the *Cerasus Caroliniana* or Wild Orange; also sycamores and pines. Various flowering shrubs and vines not in bloom at the time of our visit compose a part of the undergrowth. We were unable to obtain a sufficiently extended view by which we could form an idea of the relation of heap to heap or mound to mound, or ascertain whether any general plan had been pursued in their construction; the Floridians, residents of the neighborhood, believe them to be defensive works that were erected by De Soto; but we could perceive no basis for this belief, as the structures separately viewed are essentially the same as others we had examined.†

*Irving's Conquest of Florida, Ed. 1869, p. 447.

†In none of the mounds examined by us were found any ornaments for personal adornment made of shells. From mounds in other places in the Southern States articles for that purpose have been obtained. In the Smithsonian Institution, No. 1627 of the Ethnological specimens, is a pendant for a necklace or ear-drop made of a piece of a species of Busycon which was found in a mound in Texas; also in the same collection, No. 5811, is a roughly polished valve of *Unio gibbosus?* perforated, found near Sulphur Spring in the neighborhood of Nashville, Tennessee; No. 7654, also Smithsonian Col-

The account of the landing and movements of De Soto thereafter does not show that he remained at or near the place of debarkation, save but for a short time, for the purpose of giving his men a few days rest after the confinement of shipboard. If he had made this a base or point of support for subsequent operations it is probable that he would have caused earthworks to have been erected, but otherwise it would have been unnecessary and useless labor; as above stated there is nothing in the character of the mounds and heaps that show any difference from similar structures elsewhere met with by us.

This locality was undoubtedly the site of a populous Indian town; the ground in the neighborhood is rather above the average height, and the position such as to make it particularly healthful in the summer and autumn. The waters abound with fish at certain seasons, and the neighboring islands furnish abundance of oysters and other mollusks that were apparently considered edible by the Indians. Near this place, and inside of the keys, we gathered for our use as food, quantities of Quahaugs (*Mercenaria Mortonii* Conrad), of mammoth size and excellent quality; a pair of the empty valves sometimes weighing between three and four pounds! At low tide can be collected the reversed Conch (*Busycon perversum*) and the Horse Conch (*Fasciolaria gigantea*), of which it is supposed the Indians made their war-trumpets.* Here also abound not only many smaller molluscous animals of sufficient size to be important for food, but the Thorny Conch (*Melongena corona*) elsewhere alluded to. The bleached shells of the species named are

lections, is a convex disc of shell (species unknown) from a mound in Union County, Kentucky; this last was collected by my friend, Major S. S. Lyon, of Jeffersonville, Indiana.

* Another large shell, the beautiful *Triton variegatum*, is used as a war-conch by the natives of many of the Indo Pacific Islands. See specimens in the Ethnological collection of the Smithsonian Institution (3825) from Carlshoff Island; (3490) Samoa Island, and (2907-8) Fejee Islands (called by the natives u-d-a-v u-i). These specimens are a part of the material collected by the U. S. Exploring Expedition under Commodore Wilkes.

found in all of the Kjœkkenmœddings on the western coast of Florida, as far as we explored.

On some of the smaller islands the pelicans, gulls, and other maritime birds deposit their eggs, and on the larger keys raccoons and deer are abundant. The occasional visit of a Puma (*Felis concolor*) sometimes arouses the slumberous quietude of the isolated settlements; a quietude at the present day undisturbed by the war-whoop of the savage, and seldom broken except by the music of the mocking-birds, or the noisy screeching of the parrots (*Conurus Carolinensis* Kuhl). The great requisite for the sustentation of large numbers of barbarous people exist here now as they did centuries ago. Along the base of a ridge of shells, which is situated so near the edge of the bay as sometimes to be washed by its waves, we picked up several arrowheads and small fragments of pottery. About half a mile below a new settler had just planted his stakes and was building a cabin, his nearest neighbor resides two miles above. Driven from his native state by the rude and chilling breath of the north wind, and suffering from pulmonary troubles, he here seeks and will measurably find what Ponce de Leon sought, the "fountain of health," provided he does not succumb to the fever and ague, of which there is a chance. Near his new home there is a creek where alligators (*A. Mississippiensis* Gray) watch with jealous eyes the invasion of their domain. As the presence of the huge reptiles frightened the children when they went to the creek for water, one of our party proceeded to the spot and slaughtered a saurian some ten feet in length. We were told of cases where pulmonary patients "with one foot in the grave" and one hand upon the door knob, evaded eternity, at least for a term, by eating alligator meat; and alligator oil we were assured is a specific against pulmonary consumption. If the oil of the alligator has any connection with its power of extending the jaws, we have no doubt a moderate dose might enable the most despondent invalid to grin. Of one fact we are cer-

tain, they have no *ear* for music. A young living specimen, two feet long from snout to tip of tail, upon which we expended sundry vocal performances of a high order, manifested not the slightest appreciation, and we were never encored. Chagrined at the apathy of the audience we deliberately insulted it by reciting aloud, and in the most sarcastic manner, the following verse:

"How cheerfully he seems to grin,
How neatly spreads his claws,
And welcomes little fishes in,
With gently smiling jaws."

But the voracious beasts not only "welcome little fishes in," but frequently attack dogs and pigs, and instances are known of their attacking children and men.

We remained within two or three miles of the mound anchorage for several days collecting along the shore, or in the lagoons and marshes. Provided with well greased long boots we waded for miles, and at low tide could have crossed from the main land to the opposite keys, so shallow is the water, had not a narrow but not deep channel prevented. Sometimes at night we slept by our camp fires ashore, or, according to the caprice of the moment, on board of the schooner, during the twilight spinning yarns or relating adventures in other places, or listening to the serenade of the drum-fishes swimming alongside, until sleep, "the giver of sweet visions, came."

From Point Pinalles it is but a short sail to Long Key. Upon the easterly side of the latter we found many specimens of *Fasciolaria tulipa* and *F. distans*, but much handsomer shells of these species may be obtained upon the outer shore of the key; those from the inside are covered with a confervoid growth that is somewhat difficult to remove, and when clean the shells retain a green stain. The southerly end of this island is the best collecting ground; the beautiful Winged Conch (*Strombus alatus* Gmel.), the great Cockle (*Cardium magnum* Bom.), the heart-shaped Cockle (*Cardium isocardia* Linn.), a curious thorny Oyster

(*Chama arcinella* Lam.), and the fine bivalves *Callista gigantea* and *C. maculata*, and many other molluscan forms of interest and beauty are quite numerous. The water deepens rapidly upon the outside of the key, and many species may be found upon the outer beaches that are rarely met with on the shore of the main land. While walking near the edge of the water the surf rolled up a fine living specimen of the odd-looking trigonal Trunk-fish (*Lactophrys camelinus* DeKay), sometimes called Cow-fish, a profile view of the head much resembling that of a cow; and along the drift rows a few specimens of a Sea-cucumber (*Holothuria*), which look like an empty bead purse. There is a large species found in Puget Sound that is eaten by the Indians, and the *Holothuria edulis* is regularly collected by the Malays in great quantities, dried, and sold to the Chinese who regard it as a delicacy. We prefer broiled quails. Specimens of the switch-like Gorgonia (*Leptogorgia virgulata* M.-Edw.) are mixed in with the drift; and attached to the bases of many of the specimens is the queer Ark-shell (*Arca Noæ* Linn.), called Noah's Ark; here also are large sponges, shaped somewhat like a vase. The business of sponge collecting is quite profitable. At the present time there is an increased demand for the coarser species, as, after proper preparation, it makes a most excellent filling for pillows and mattresses. The sponges furnish numerous microscopic forms of wonderful beauty, and fossil sponges are found in many of the geological strata in Great Britain.*

Having added largely to our collection during our pleasant stay upon Long Key we again got under way, and early in the afternoon of a mild winter day we came to anchor in the pass at the end of Pine or Piney Key, and soon after went ashore. This little island is one of the most delightful spots on earth; it is covered with vegetation almost to

* While the green sand, the upper chalk, and the Kentish rag were forming, corals and sponges grew in every sea . . . . . . The Brighton pebbles and the Wiltshire flints are principally petrified sponges . . . . . (Milton's "Stream of Life.")

the water's edge. It is encircled by an outer growth of mangroves. Pressing through these, and crossing to the opposite side of the key, we passed through successive zones of palmettoes, buttonwoods, etc., and intervals, where the rank grass is from three to four feet high; in one of these we made a camp, and all hands went vigorously at work cutting and hauling the boughs of dead fallen trees for our night fire. Quite near to the camp is a narrow bayou, which indents the shore so as to resemble a huge drumstick with the knob or head inland. At low tide this knob or head is separated from the other portion, or handle, by an oyster bar, from which we obtained a great quantity of delicious oysters of large size; here also we found many other species of mollusca, some of which are quite rare, including a beautiful cone-shell. The sandy part of the oyster bar, as well as the narrow beach, was closely dented with the hoof-prints of deer, and the footprints of "coons." In many places sturdy thistles, and cacti of large size, furnish a hiding-place for the snails, *Helix cereolus* and *H. uvulifera*, and the dense undergrowth a nesting-place for the birds. As the sun had sank so far below the tree tops as to shade our camping-ground we started our evening fire. Tramping and the salt sea-air gave a keenness to the appetite that caused the supper of stewed and roasted oysters to disappear in a marvellous short time. Having finished our repast we filled our pipes and from time to time piled fresh fuel on the fire and watched the flashing flames.

It was a brilliant night, serene and cloudless, and the moon was near the full. The buttonwoods and palmettoes glistened in the silver light which descended from above, and were tinged by the ruddy glow of our huge camp-fire which lighted them from below, making each tree in the foreground distinct in vivid lines of beauty; the dark recesses of the denser growth occasionally illuminated by a flame which streamed up for a moment and disclosed colonnades of pines and palms, standing equidistant and regular

as if placed by human hands. It required no flight of the imagination to transform these charming forest vistas into the long, dim, aisles of cathedrals; the trunks of the trees forming the pillars, and the graceful leaves of the palmetto, overarched, forming a roof.

"The groves were God's first temples."

We sat up late, enjoying the glories of the night, the last of our out-door camping in Florida. Early the following morning we "broke camp" and prepared for the return trip to Cedar Keys. Hoisting the anchor with a cheerful "heave yo," the sails of the Santa Maria soon filled, and we were homeward bound. We gave a farewell look by way of a parting salute to Piney Key, as it stood out bright and beautiful in the purple light of the morning:

The slanting sun shone white along the sand,
  Strewn with green sea-weeds and with crimson shells,
  Out of the ocean's dim mysterious cells,
Jewelling all the broadskirts of the land.

Arriving at Cedar Keys after a pleasant voyage, we proceeded homeward over the same route by which we came.

The winter climate of Florida is not only healthful but delightful; in the summer there is danger of contracting fever and ague, and the yellow fever is an occasional visitor. The climatic advantages to the invalid are at the present time counterbalanced by the miserable food and discomforts of the hotels and boarding houses; there are undoubtedly exceptions to the last objection, but they are rare. The expenses of a three months trip are quite heavy and we could make a journey to Europe or California, of the same duration for the same cost, and live infinitely better in bed and board.

In an agricultural point of view Florida offers no inducements to the emigrant or settler that are not surpassed by many other sections of the country, whether quality of soil, facilities of transportation, accessibility to markets, or variety or capabilities of production are considered. An emi-

gration of enterprising and industrious people, in sufficient numbers so as to exercise a controlling influence, would in a few years effect a great change for the better, and place the State in the line of progress. The average Floridian of to-day understands only one thing, and that is "how *not* to do it." Emigration should be by colonies, and should include some mechanics, and be well provided with all necessary agricultural and mechanical implements and material, in order to be successful, and great care should be exercised in the selection of a location.

The trip to Florida, of which these "Rambles" afford a mere outline, was not devoid of scientific interest, and the results will be made known at some future time, either in the NATURALIST or some other appropriate publication.

THE NATURALIST IN CALIFORNIA.

BY J. G. COOPER, M. D.

NO. II.

The Colorado Valley in winter.—I arrived at Fort Mojave, after a journey of sixteen days from Los Angeles,* on December 19th, 1860. This post is situated close to latitude 35°, where the boundary line of California strikes the river, and although on the Arizonian side, has, probably, no species of animals not also living on the west bank of the river, unless *Lepus callotis* be an exception. This, the Texan hare, I found common there, while *L. Californicus* is the prevalent, if not the only large species westward. The valley of the Colorado at this post is, probably, ten miles in width, and formed of a succession of gravelly terraces, or *mésas*, with a narrow sandy bottom intervening,

*Not Angelos, as printed before. Spanish, not Italian.

not over a mile wide. The whole upland has a most barren and desolate aspect, the only vegetation being low shrubs of the fetid *Larrea Mexicana*, with cacti and other thorny plants beneath. The bottom land, however, supports a vigorous growth of cottonwood, willows, and mesquite, a name applied there to two quite different trees, the *Algarobia glandulosa* and *Strombocarpa pubescens*. Dense shrubbery and coarse grasses cover most of the ground, even under the darkest shade, though spots are sometimes too alkaline for any vegetation except a few sea-shore plants, and in places the winds keep up a rolling waste of sand hills. The river itself is so low in winter that the Indians can wade across with their heads above water, and is so muddy as to fully deserve its name.

After my desert experience, I gazed with delight on the broad flashing stream, with its forest-clad banks, even though the trees were then bare, and the whole country nearly of the same brown tint as the river, for I knew that the very barrenness of the surrounding regions must drive most of the animal life to the river banks, one class in search of vegetable food the other to prey upon the former, while such as loved water must necessarily seek it here. And, with the exceptions mentioned as desert animals in my former article, nearly all of the higher animals are confined to this narrow belt of timber, stretching along the course of the Colorado from its Great Cañon, thirty miles higher up, down to its mouth. Those living permanently on the uplands must depend on a very scanty supply of dew for water during most of the year.

I must remark here that in climate this region belongs to Mexico, the winter being the *dry* season, and the summer subject to violent thunder storms from the south, but not *wet*, the whole annual rain not exceeding three or four inches, of which perhaps *one* falls in winter. The temperature rarely falls below the freezing point in latitude 35°, although the surrounding mountains were white with snow

on several occasions during January. The elevation of the river at this point is not over 550 feet, and the whole bottom land is inundated nearly every summer. The distance by the course of the river from its mouth is 400 miles.

The fauna of the valley naturally partakes much of the Mexican (west slope) character, and has some peculiarities. It is too limited and too liable to inundation for many land mammalia to flourish in it, except such as are common to the neighboring deserts and mountains. A second species, at present known no farther west, is the Leaf-nosed Bat (*Macrotus Californicus*) from Fort Yuma. This bat, like the birds, is independent of floods, and is probably migratory southward in winter, like two species I obtained at Fort Mojave—the Pale Bat (*Antrozous pallidus*), and a small species of *Vespertilio* which did not appear until March 15th, though the climate was warm enough for weeks before.

On walking out with my gun I was struck with surprise at the great numbers of Abert's Finch (*Pipilo Abertii*) frequenting the grove, the flocks flitting before me like dry leaves before the wind, their color exactly resembling the prevailing hue of the foliage covering the ground, and now densely coated with brown dust. It recalled the observation I had often made as to the prevalence of this brown hue in so many birds of California, of different genera and families, but agreeing in their habit of living in low shrubbery which has the same brown and dusty tint for eight or nine months of the year. The loud call or alarm note of this bird was strikingly different from the notes of its more silent cousin near the coast, the *P. fuscus* (or *crissalis*), but I soon noticed another strange fact, namely, that this note was also uttered by two other very distinct birds of dissimilar habits, the Shining Flycatcher and Gila Woodpecker (*Centurus uropygidlis*), both of which were abundant and feeding together on the berries of the mistletoe, parasitic on almost every tree. These birds were my first specimens, together with the common Grass Finch (*Poœcetes grami-*

neus) and Chipping Sparrow (*Spizella socialis*), which were wintering there in small flocks.

Next day I was disgusted to find my specimens damaged by mice, and, on setting a trap, soon secured some which I cannot distinguish, except by a lighter hue, from the common woodmouse of California (*Hesperomys Gambellii*). These, with several other rodents, had taken up their residence in the thatched roofs of our *adobé* quarters. On Christmas eve a little ice formed in the valley, but next morning the Brown Thrush (*Harporhynchus crissalis*) of this region was singing melodiously, and exactly in the style of its cousins east and west, so well known as "False Mocking Birds." It is another of the dead leaf-colored birds of the western regions, and is as strictly limited to the groves as its pale sandy-hued relative, *H. Lecontei*, is to the desert shrubbery.*

The end of the year was cold and stormy for this latitude, so that no additions, except more northern migrants, were obtained among the birds, the most notable being the Oregon Snowbird (*Junco Oregonus*), and a few of the Meadow Lark (*Sturnella neglecta*), with several species of ducks and geese. In January, Swans (*Cygnus Americanus*) also appeared for a few days. On Jan. 10th I was both surprised and pleased to obtain a beautiful specimen of the Bohemian Waxwing (*Ampelis garrulus*), which had wandered so far from the mountains north-eastward, where the species abounds, and, probably driven by storms, had sought a temporary refuge in this far southern latitude. It was a solitary straggler, and even its cousin, *A. cedrorum*, never appeared there during my residence.

On the 16th a solitary Mexican Flycatcher (*Myiarchus Mexicanus*), evidently almost starved, gave a specimen of the summer group of migrants lingering in the valley

* I may here correct an error caused by the transposition of a line in my last article. "Corresponding in color to the rocks among which it lives," was intended for Harris's Squirrel, though it *would* apply pretty well to the Sage Fowl under which it is printed.

through the winter. Vegetation was just commencing to bud forth now, and I observed a few Doves and Cow-birds (*Molothrus pecoris*), apparently attracted by the opening spring, as none appeared before. I cannot enumerate all the species of vertebrates which now amounted to over fifty, as I collected them, but must notice only the more remarkable. The resident species not found westward of this valley were the Ladder Woodpecker (*Picus scalaris*), the White-bellied Wren (*Thriothorus leucogaster*), Gambel's Quail (*Lophortyx Gambellii*), the Arizona Song-sparrow (*Melospiza fallax*), the lead-colored Gnatcatcher (*Polioptila plumbea*), Malherbe's Flicker (*Colaptes chrysoides*), and the Yellow-headed Titmouse (*Auriparus flaviceps*). Besides these, most of the species before mentioned are resident, and also many common to the coast regions. Frosty nights throughout January seemed to prevent the appearance of any new birds. Even in February the new comers were only such as I know winter in more northern parts of California near the coast, though the thermometer rose to 80° on the 20th.

February 27th, a few Bank Swallows (*Cotyle riparia*, or *serripennis**) and bicolored Swallows (*Hirundo bicolor*) appeared. Even these last winter near the coast much farther north, to latitude 37°. It appears that there is little migration along this valley of the species common in summer near the coast, as they have to cross the deserts, and prefer a more western route. Some of the *winter* residents however became more scarce, probably seeking the mountains or high lands not more than a hundred miles distant, while the strong-winged hawks and swimmers may have gone even to the arctic regions.

Spring.—By March 2d, the poplars ("cottonwood") were in nearly full leaf, and beautiful flowers covered the richer

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*Dr. Kennerley found this species here "abundant," February 21st, 1854. Also, the White-throated Swift (*Panyptila melanoleuca*), at William's Fork, February 18th, and Western Whippoorwill (*Autrostomus Nuttallii*), February 23d.

and warmer spots, chiefly in the ravines of the neighboring mountains. A duck was seen by an old resident on the river, which he said was very rare there, and from description was probably the long-legged Tree-duck (*Dendrocygna fulva*), since found to frequent the Sacramento Valley for nine months of the year, and to breed there; one of the few peculiarly western species. I shot or observed many other species of aquatic birds while here, but they furnished no very interesting facts. I obtained one each of the Red-necked and Williamson's Woodpeckers (*Sphyrapicus nuchalis* and *Williamsonii*), the only ones seen, and probably stragglers from the north.

I had been ten weeks at the post before I saw a single Burrowing Owl (*Athene cunicularia*), and then found only one pair, several miles distant, inhabiting a burrow evidently freshly dug by themselves. In the absence of the large burrowing squirrels, or other animals of similar size, they are sometimes compelled to burrow, but do not seem to increase in numbers in such localities. The general hardness of the soil on the upland is also an obstacle to their digging.

On March 10th I observed the first Hummingbird (probably *Atthis costæ*, which Dr. Kennerley found in February 1854, in the warmer valley of William's Fork), and the same day saw large flocks of geese migrating north. The first Rattlesnake (*Crotalus atrox*) was killed this day, and I obtained the first Horned Lizard (*Doliosaurus platyrhinos*). The weather now being very warm, flocks of cranes, swallows, and various winter residents were seen going northward daily. On the 15th I saw the first Bat and Western Whippoorwill, and on the 19th shot another Mexican Flycatcher, probably also a winter resident. There is evidently a constant moving northward of the winter residents, but apparently none from Mexico.

On March 22d I obtained the first seen of the Pale Sparrow (*Spizella pallida* *), which seems to go farther south to

* Decidedly this and not *S. Brewerii*, which Coues supposes to replace it in Arizona and westwards.

winter than the *S. socialis*, but the first birds which I could consider as probably the leaders of the summer migration, were, as it happened, of a new species, viz., *Helminthophaga Luciæ*, or Lucy's Warbler, which I shot at first sight on March 29th, the two first being males, and attracting my notice by their notes, as their small size and concealment in the dense mesquite thickets, which were just leafing out, would have otherwise prevented their discovery for a long time. They may even be winter residents in the valley like the allied *H. celata*.

The first nest I found with eggs was that of a Shrike (*Lanius excubitoroides*) on the 19th, and on the 26th obtained the first eggs of the Quail, of the Yellow-headed Titmouse (which builds an extraordinary closed nest of thorny twigs, like the magpies's in miniature), and of Abert's Pipilo.

Burrows were not uncommon which may have been made by Foxes or by the Badger (*Taxidea Americana*). On March 30th, visiting a steel trap which I had set for burrowing animals I was surprised to find in it a Swift Fox (*Vulpes velox*) caught by the toes. Having no way of securing it alive, I was obliged to make a dead specimen of it at once, fearing it might tear itself away. This is one of the mammalia which has not yet been detected west of the Colorado, though it undoubtedly exists there, and is indeed but a dwarf variety of the common Red Fox. Other mammals which I had obtained were Gambel's Woodmouse, before mentioned; Audubon's Hare (fur finer than near the coast, approaching *Lepus artemisiæ*), Coyoté (*Canis latrans*), killed by the dogs while running through the camp one moonlight night in January; Brush-tailed Rat (*Perognathus penicillatus*), quite common in the thatched roofs; Dark Woodmouse (*Hesperomys austerus?*), before found only in Washington Territory, but undistinguishable by descriptions; Boyle's Woodmouse, probably a mere long-tailed variety of Gambel's; the Mexican Woodrat (*Neotoma Mex-*

icana), common and very large; Phillip's Jumping-rat (*Dipodomys Phillippii*), common, and an invader of dwellings. The Texan Hare I have already mentioned. The Indians also brought in a fawn, apparently of the *Cervus Columbianus*, which seems to be the common species along the river, although others probably exist. They also brought a young antelope, of which herds were seen on the neighboring mésas during the short period of green vegetation in spring. A Wild-cat (*Lynx rufus*) was often seen at dusk about the post garden, where I attempted to shoot it but failed for want of light. My inquiries about the Californian Opossum found along the Mexican boundary, did not indicate its existence in this valley, though it will be found there if anywhere in California, nor did I learn of any other carnivorous mammals. Beavers are quite common in the river and grow to an enormous size; Gophers (*Thomomys fulvus*) are also common.

Compared with Kennerley's collections, in 1854, and Coues', in 1865, at Fort Whipple, the first quarter of 1861 must have been unusually cold. April proved to be the month for the arrival of the great body of summer birds, although a week before I saw what I took to be a Fork-tailed Flycatcher (*Milvulus forficatus?*), a species never yet obtained west of the Rocky Mountains, and a Scarlet Flycatcher (*Pyrocephalus Mexicanus*), which is a rare summer visitor, about which I could not be mistaken, though neither would allow of a near approach. I obtained the following, usually as soon as observed: April 2d, *Atthis costæ;* 3d, Bullock's Oriole (*Icterus Bullockii*); and saw an *Empidonax*, Barn Swallows, and Summer Yellow-bird; a ground Cuckoo (*Geococcyx Californianus*) laid an egg in its cage. 11th, shot an Obscure Flycatcher (*Empidonax obscurus*). 17th, Texan Nighthawk (*Chordeiles Texensis*), and saw the first eggs of Orioles. 24th, McGillivray's Warbler (*Geothlypis McGillivrayi*), Yellow-breasted Chat (*Icteria viridis*, not long-tailed), Arkansas Kingbird (*Tyrannus verticalis*).

25th, found the eggs of Common Doves. 26th, shot a new species of Owl (*Micrathene Whitneyi*) in a dark thicket. 28th, Summer Red-bird (*Pyranga æstiva*). 29th, found a nest and two eggs of the Shining Flycatcher. In this month I saw an unknown species of Oriole in the high trees, like *Icterus Parisorum* Bonap.

On April 6th I trapped a squirrel, of a species which I had not before observed, a third larger than Harris', and dark-brown instead of gray, but with proportions and markings so exactly like the desert species, that, remembering the varieties of the Four-striped Tamias, I did not dare to consider this distinct. It was all I saw of the kind, which may be common in the wooded mountains of Arizona. On the 13th I obtained the first Pale Bat, before noted.

Reptiles had now become common in the valley, and were mostly distinct species from those of the deserts. Besides those mentioned, a large Fence Lizard (*Sceloporus magister?*), eight inches long, began to frequent the trees March 20th, and on the 23d, three young of my new Land Tortoise (*Xerobates Agassizii*) were brought from the mountains by Indians. The Thirsty Lizard (*Dipsosaurus dorsalis*) became common in the ravines near by, far from water. On the 30th I caught Graham's Salvadora (*S. Grahamii*), a pretty harmless snake living in the grassy valley. April 15th, Woodhouse's Toad* first appeared on the drier banks; 17th, Churchill's Bull-snake (*Pituophis bellona*); 26th, Boyle's Milk-snake (*Lampropeltis Boylii*); 29th, the Coppery Whip-snake (*Masticophis testaceus*), and some very swift lizards (*Crotaphytus* sp.) which I did not succeed in catching, appeared on the desert plains.

On May 1st I shot the Little Flycatcher (*Empidonax pusillus*), which I then mistook for *E. Traillii*, but find by my notes that this one differed from a true specimen of the latter, shot on May 20th, in having the lower mandible brownish instead of yellowish and in proportions. It was lost, with

* Dr. Kennerley found toads at William's Fork, February 18th, 1854.

a valuable collection sent by the "Golden Gate," on the way to Washington, but I happened to reserve the other one, about the occurrence of which west of the Rocky Mountains there has been some discussion.*

May 6th, shot the first Blue Grosbeak (*Guiraca cœrulea*); 14th, the Blue-headed Greenlet (*Vireo solitarius*†), which Dr. Coues omits from the birds of Arizona, supposing it to be his *V. plumbeus*, which however is quite distinct, and one I did not obtain.‡

May 19th I found a nest of the Yellow-breasted Chat containing three eggs, besides one of the parasitic Cow-bird; on the 8th a nest of the House Finch, or Red Linnet (*Carpodacus frontalis*), with eggs, and on the 19th that of the Song Sparrow (*Melospiza fallax*).§ May 20th I first saw the Blue Linnet (*Cyanospiza amœna*), and shot Hammond's and Traill's Flycatchers (*Empidonax Hammondii* and *E.*

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* See Coues' List of Birds of Fort Whipple, Arizona, in "Proceedings of the Philadelphia Academy of Natural Science," January, 1866. Compare also Coues, in "Ibis," April, 1865, and July, 1866; Baird on Distribution of Birds, in "Silliman's Journal," and my article on Additions to the Fauna of California, in the "Proceedings of the California Academy of Sciences," IV, iii, November, 1868.

† Length 4.87; extent 9; wing 3 inches; bill black; lower mandible bluish; feet lead color; iris brown; male.

‡ I take this occasion to notice the prevalence of lead-gray among the arboreal birds of these arid regions, just as brown prevails among the more terrestrial. It replaces the brown, olive or greenish, in many species also found in moister and more wooded regions, while others, differing in other respects from their eastern representatives, are considered as distinct species peculiar to these regions. The Pigeon Hawk (*Falco columbarius*), Mottled Owl (*Scops asio* var. *McCallii*), Night Hawk (*Chordeiles popetue* var. *Henryi*), *Icteria viridis* var. *longicauda*, *Thriothorus* (*Bewickii* var.?) *leucogaster*, *Pooecetes* (*gramineus* var.?) *confinis*, *Melospiza* (*melodia* var.?) *fallax*, *Sturnella* (*magna* var.?) *neglecta*, and Ground Dove (*Chamæpelia passerina* var. *pallescens*), furnish examples of more or less marked differences in this respect from those of other regions. The gray species as usually recognized, are the Hare Hawk (*Falco polyogrus*), Squirrel Hawk (*Archibuteo ferrugineus*), *Micrathene Whitneyi*, Nuttall's Whippoorwill (*Antrostomus Nuttallii*), Western Kingbirds (*Tyrannus vociferans* and *verticalis*), Say's Pewee (*Sayornis Sayus*), *Empidonax obscurus*, *Polioptila plumbea*, Grace's Warbler (*Dendrœca Graciæ* Coues) of Fort Whipple, *Helminthophaga Luciæ*, Swainson's Vireo (*V. Swainsoni*), Lead-colored Vireo (*V. plumbeus*), Coues' Vireo (*V. vicinior*); these last three from Fort Whipple; Little Vireo (*V. pusillus*), Lead-colored Titmouse (*Psaltriparus plumbeus*), Lawrence's Goldfinch (*Chrysomitris Lawrencii*), Pale Snowbird (*Junco caniceps*), all of which have darker-colored representatives either east of the Mississippi, or on the west coast, or both, while some of them extend their range to one or both of those natural boundaries.

§ The nesting, as well as the arrival of many birds, was from one to two months later than at San Diego in 1862.

Traillii); also, Richardson's Pewee (*Contopus Richardsonii*) and Black-cap Warbler (*Myiodioctes pusillus*).* The only mammals I obtained were a small Bat (*Vespertilio Yumanensis?*), and the typical gray variety of Harris' Spermophile, shot some miles from the river on May 28th, the day I started to return to the coast. The reptiles added were the Colorado Toad (*Bufo alvarius*), an enormous semiaquatic species nearly as smooth as a frog; and several others on the way westward which do not appear to inhabit the valley.

Fish seemed to be scarce in this muddy river, and I only obtained three species of cyprinoids: a large one called Colorado Salmon (*Ptychocheilus lucius*), a Gila (*G. robusta?*), and one allied to the Suckers (*Catostomus*). Mollusca were equally rare, and a few specimens of the remarkable *Physa humerosa* and *Planorbis ammon* were all I found. My collection of vertebrata made at Fort Mojave numbered 100 species, and 250 specimens.

I might enumerate many other species that have been obtained in the Colorado Valley by other collectors, but it would be too long a list. I have, altogether, counted up twenty-three species of mammals, one hundred and nineteen birds, and ten reptiles, as found there at various seasons, some of which I heard of as visiting Fort Mojave later than my stay there. By May 15th the spring rains were over and the short vegetation of the mésas was drying up. About this time also the river was rising rapidly, bringing down cold water from the mountains, and moderating the heat which had been as high as 116° in the shade on April 20th. The summer wind began to blow from the *south*, and would, probably, bring some of the latest birds with it, while others would come after the floods to seek the food left by the subsiding waters. Among these have been seen the strange Vulture-eagles (*Polyborus Audubonii* and

*On the 27th I saw the only one of the rare Western Warbler (*Dendrœca peridicitalis*), and the first Sea-green Swallows.

Craxirex unicinctus), the little Ground Dove, and the quaint Wood Ibis, called there "Colorado Turkey" (*Tantalus loculator*).

My object has been to give merely a sketch of the progress of the faunal seasons, as I saw them.

HINTS ON TAXIDERMY.

BY C. A. WALKER.

[Concluded from page 201.]

The method of skinning and mounting tortoises and turtles. —By examining the exterior covering of this order it will be seen that it consists of two horny plates or shields, which are closely united at the sides, forming a protection to the soft parts of the body; the upper one is called the carapace, and the lower one the sternum or breast bone. Before commencing the operation of skinning it is necessary to separate these two plates by means of a strong knife, chisel, or other similar instrument, or a fine saw, taking great care to make the separation at the suture, as far as possible, and to avoid cracking the shell. After this operation has been finished remove all the flesh adhering to both the upper and under plates. The arrangement of the bones and muscles differs so essentially from that of the other orders of vertebrates that attention should be given to this point in removing the various parts. The fore and hind legs should be turned out, and all the flesh adhering to them removed, taking care not to separate these various parts from their attachments to the upper shell; also, the neck and head should undergo the same operation, the brain and eyes being removed. The inner surface should now be thoroughly cleaned by means of a stiff brush, and the preservative applied to every part, after which they may be restored to

position, having previously filled the eye sockets and cavity of the brain with cotton. In stuffing, commence by restoring the neck to its natural form with cut tow. A wire (the body support), well pointed, should next be inserted at the top of the head, upon the outer surface, and passed down through the cut tow within the neck, across the space previously occupied by the body, and thence through the tail until it protrudes at the tip of the same. The other wires, or leg supports, should be inserted at the soles of each foot, up within the skin of the legs, and secured firmly to the main body support. The adjustment of the wires is essentially the same as recommended in the mounting of the larger mammalia. The various muscles should now be imitated with cut tow, and the upper and under plates joined. This may be accomplished by bringing them together, and boring four small holes with an awl, two at one end, the one above and the other beneath the suture, and the same at the other end, uniting them by means of fine annealed wire. Cement may also be used with advantage in this operation. The carapace may be cleaned with a weak solution of nitric acid and water, washing it freely; afterwards it may be oiled and rubbed with a piece of flannel.

Of crocodiles and lizards in general.—All of the smaller species should be preserved in spirits, of about 75 per cent strength. The larger of this group are skinned in the same manner as a quadruped; especial care is, however, required in skinning the tails, as they are very liable to break. But little preservative is needed, the skins being of a dry nature. They may also be stuffed in the same manner as a quadruped, and little skill is required to get them in shape.

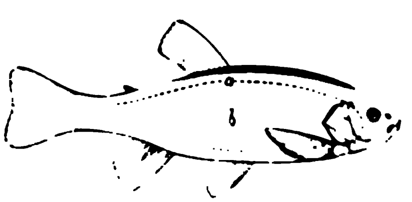
Of serpents. With the larger specimens, such as cannot be readily preserved in alcohol, the following method should be adopted in removing the skin. Open the mouth to its utmost capacity and insert therein a stick to retain it in that position. With the aid of the scalpel sever the body from the head within the skin, leaving no attachments whatever

Grasp the body with the pincers and pull it out through the mouth, and fasten it to a hook. The body is now to be pulled from the enveloping skin; to accomplish this it is necessary to avoid all strain, that the scales upon the outside may not be disarranged, using the scissors and scalpel to sever the ligaments which bind the skin to the carcass. There is no necessity of turning the skull, but the brain should be removed through an opening at its base. The muscles within the mouth, and the eyes, should also be taken away. The whole should then be anointed with the preservative, and the skin reversed to restore it to its natural position. Before stuffing, suspend the skin in a vertical position, with the head uppermost. The form can now be restored with sawdust; this may be run through a tunnel, using a slender stick, from time to time, to lay it evenly. Having reached the mouth insert some putty to keep the sawdust from spilling out. The specimen may now be taken down and bent into any position wished, being supported by a wooden framework until thoroughly dry. In order that the specimen may be free from the attacks of noxious insects it is well to soak the sawdust in a solution of carbolic acid and water previous to placing it within the skin; and it should be thoroughly dry, otherwise the skin is liable to mould. Sand can also be used to imitate the form, but the chief objection is its great weight.

Of the method of skinning and mounting fish.—This class of animals possess many beauties, which, when thus removed from their native element, vanish forever, and it is in vain for the taxidermist to try to imitate those iridescent tints which characterize the living specimens. The best he can do is to preserve in form and general outline those characteristics by which he may be able to recognize his subject. Before proceeding to describe the operation of skinning it may be well to state that the scales, as well as their color, may be preserved to a certain degree by applying tissue paper to them, which, from the natural glutinous matter

which covers the scales will adhere firmly; this being allowed to remain until the skin has dried may be easily removed by moistening with a damp cloth. All small fish should be mounted in section, while the larger varieties may be preserved entire. Suppose the fish to be of such a size as to be mounted in section, first, it is necessary that it be as fresh as possible, as the scales will become detached if decay be allowed to commence. Lay the fish on one side and cover the side uppermost with tissue paper, as stated above; also extend the fins by means of the same, and allow them to remain a few moments until they become fixed and dry; this will be a protection to the fins and scales during the process of skinning. Having provided yourself with a damp cloth spread it smoothly upon the table, and place the fish upon it with the papered side down. With the dissecting scissors cut the skin in the manner indicated by the dotted line *a*, in Fig. 77, and remove the skin [illegible] included within the line. The remaining skin must now be detached from the flesh, beginning at the head and separating it downward toward the tail. The spine must be severed close to the head, and also at the tail, and the entire body removed. All the flesh having been taken from the skin, and the eyes removed, the inside must be wiped [illegible] and the preservative applied. It is necessary here to repeat the caution not to use any unnecessary strain that will be liable to distend the skin. The skin should now be filled with cotton or tow, and this must be laid so evenly that there shall be no prominences upon the outside of the same. When filled it should be laid with the open side down, upon a board of proper dimensions previously prepared, and fastened to it by means of small tacks, commencing at the head, and fastening the edges (as at A, Fig. 77) downward toward

Fig. 77.



the tail. It should then be set aside in the air to dry, care being taken not to expose it to the rays of the sun. When dry the paper which covers the exposed side and with which the rays are distended, may be removed in the manner previously stated, and the glass eyes inserted with a little putty. As the glass eyes used by taxidermists are generally too spherical, and polished, it is well to manufacture them of wood, using common paint to restore the color, avoiding the use of varnish. Finally the skin should receive a coat of thin colorless varnish, after which it is ready for the cabinet. In sharks and large fishes an incision should be made below the head at its base, along the ridge of the back, following to either side of the dorsal fin down to the tail. The skin can then be separated on each side, and by severing the vertebræ at the head and tail, the entire body may be removed. The tail having been skinned, the head should be pushed inwards and the skin passed over it, when all the cartilage can be freely cut away. In stuffing these large species it becomes necessary to use a body support, and a bar of light wood may be used for this purpose; this should enter the skull, thereby being more easily kept in position, and extend to the base of the tail. Hooks can be fastened to this bar, and by means of wire the specimen can be suspended from above. The body should then be stuffed with hay, and the incision upon the back carefully sewed up. If the first coat of varnish is observed to rise in scales it should be removed with a solution of nitric acid and water, and the skin allowed to dry, when a second application of varnish will ever afterwards remain quite solid.

We may state in conclusion that with the exception of large turtles, alligators and their allies, large sharks and a few other fishes of great size, stuffed specimens of the two classes of reptiles and fishes are very unsatisfactory to the naturalist, and that whenever it is practicable to preserve the specimen in alcohol that method should be adopted in place of skinning and stuffing.

THE FRESH-WATER AQUARIUM.

BY C. B. BRIGHAM.

(Continued from page 377.)

It is useless, even were it possible, to give the exact amount of plants that are necessary to keep an aquarium in order. A very few pieces will be sufficient to purify the water, but as some water-plants are very beautiful, it may be desirable to have the maximum rather than the minimum amount of them in the aquarium. The fishes should have space enough to move around freely, and at the same time to be seen to advantage. Bearing this in mind my own taste would be to have as many plants as the tank would allow. As the water in the tank is changed from time to time the plants can be thinned out and the decaying stalks cut off.

The live stock of the aquarium is generally selected from fishes, lizards, snails, and mussels. One word as to the propriety of having many kinds of fish together in one tank. Some fish, such as sticklebacks or pickerel, are so voracious that either the other fish are wholly eaten up by them, or else their fins or tails are so maimed that they become objects of pity instead of amusement. Again, in selecting a stock of fish we should try to have them of a size proportioned to the tank they are to be put in. It is a great mistake to have in the tank a fish so large that it can hardly turn about; as a general rule, in our common sized tanks, the smaller the fish the better. At the same time we thus have a chance of having more specimens without diminishing too much the supply of oxygen. It is often very difficult to get small specimens of some kinds of fish, such as perch or eels. At certain seasons in the year it is the custom, in some places in the country, to draw off the water in the mill-pond and make repairs; if such a chance presents then is

the time for the lover of the aquarium to enjoy himself, for as the water is left in small, shallow holes, here and there, we shall find in these places multitudes of specimens only waiting to be preserved,—small perch in great numbers and many rare larvæ among the plants. At such a time too, we can make a choice of mussels, selecting for their beauty those whose shells are rayed with the darker shades of green. Very young bream are easy to catch in the net. Not so with those an inch or more long, and now is the chance offered to get as many as we wish. Perch and bream both need a good deal of care to make them live the year round in the tank, but they will repay a little trouble, as they become so tame if properly cared for. Speaking of the tameness of fishes it seems to be more a question of food than anything else; if fishes are fed at certain times, and are compelled to come to the top for the food they soon get into the way of coming up whenever one is near by, and will even jump out of the water at the bare finger. There is a little fish, found mostly in slowly running streams, called the roach; it is a very interesting fish for the aquarium on account of its peculiar shape and habits; it has two large side fins just behind the head, which it always keeps fully extended, looking as if it had an old-fashioned collar on. It remains motionless for the most of the time on the bottom of the stream, occasionally starting off, perhaps in search of food, only to sink down again to its former quiet position; it is easy to keep this fish in good condition in the aquarium. Young pickerel are desirable fish to have in the tanks if one can afford to keep only that kind of fish; placed with larger fish they do very well and constantly recommend themselves for their elegant movements, but with small fish, such as minnows, they live in constant war. In one of my tanks twenty-four minnows were killed within a week by a pickerel about an inch and a half long, and this while giving the pickerel a regular course of feeding on beef. Minnows have always held a high rank among the

ishes to be selected for the aquarium; collecting together in schools, tame, hardy and lively, they have qualities which few aquarial specimens possess. The stickleback (*Gasterosteus*) of which there are several varieties, is hardly a fish for the general collection; although of exquisite form, it is so fierce, especially in the breeding season, that it incessantly attacks the other fishes in the aquarium, and in a short time deprives them of more or less of their tails, making the unfortunate victims literally top-heavy, swimming with their tails, or rather what were once tails, much higher than their heads.

Sticklebacks should have a tank devoted exclusively to them and this especially if we wish them to build a nest, one of their peculiar accomplishments. Early in the spring the sticklebacks may be found in great numbers in the small ditches which drain the salt-water marshes. The male is easily distinguished from the female by its deep red color around the gills and its blue eyes, while the female has only the silvery scales. A pair taken at random usually live peaceably together; if it is in the right season they will soon look about for materials for a nest, taking bits of water-plants and even coming to the surface for small pieces of straw and sticks; with such materials they build a round nest about as large as a small English walnut, hollow in the centre and having two holes large enough to admit the fish on either side; the nest is built upon the branches of some of the water-plants. While the female is laying the eggs the male acts as guard, fiercely driving away any thing coming within a certain radius of the nest. Wh[illegible] the eggs are laid they resemble small globules of wet sa[illegible] more than anything else. The female will be seen to [illegible] these eggs quite often with her fins; this is probably to g[illegible] them fresh water and to prevent any sediment from coll[illegible] ing upon them. After a fortnight or so, instead of egg[illegible] see in different parts of the tank what at first look most very minute gold spangles as large as the head of a

pin. On closer examination we find that they are the eyes of a very small fish. Their growth is so slow that in order to preserve them it will be well to remove them to a small tank by themselves, where they can be fed by placing a piece of raw beef on the end of a string, and hanging it over the edge of the tank into the water until it is turned white, when another piece can be introduced. The stickleback, as also the minnows, is easily accustomed to fresh water by freshening the salt-water gradually until it is quite fresh and then introducing the fish into the tank. The stickleback is not the only fresh water, nest building, fish. Wood mentions a curious fish found in tropical America, called by the natives the hassar; a fish which builds a nest as carefully as the stickleback, though one "not placed in the water but in a muddy hole just above the surface." Whether we have gold fish or not in the aquarium, is a matter of taste, some persons thinking that they give the aquarium a common fish-globe look. It seems to me if we can get some small ones of a brilliant color, and of good proportions, we should be glad to receive them into the tank. The great trouble with gold fish is that they are apt to be so deformed, some with the gaunt look of a starved fish, others with a hump on the back or a larger or smaller number of fins than usual. Gold fish would be worth keeping in the aquarium for their remarkable color alone if for nothing more.

Small eels and horned pouts add to the variety of fishes in the aquarium, but both are so uneasy and so very voracious that they are not pleasing inmates of the tank; wandering up and down the sides of the tank, they seem discontented and ill at ease. Young alewives are so beautiful that one is tempted to try them in the aquarium; rarely do they flourish in it.

One of the most interesting animals for the aquarium is the triton, or water-newt; these tritons are often found in what are called, in the country, pond holes, seldom in brooks or ponds; they are perfectly harmless and will remain on the

warm hand as long as one has patience to hold them; they come up to the surface to breathe, and therefore do not consume much oxygen; they are perfectly hardy and easy to keep alive, eating small pieces of beef eagerly; they occasionally change their skins, bringing the old skin over their heads and then swallowing them just as toads do. Their odd motions in the water, often poising themselves on the end of the tail or on one toe, are very amusing. They lay their eggs in the early spring either on or between the leaves of water-plants. By the middle of August the young are nearly two inches long; they breathe at first with gills, but by September they come to the surface for air, as the older ones do. These tritons outlive all the other specimens in the tank, and they live so peaceably with their companions that they are invaluable as aquarial specimens.—*To be concluded.*

REVIEWS.

The Development of Insects.—Naturalists are now paying increased attention to the embryology of the articulates. After Rathke, Herold, and Kölliker had published their memorable works, there was an interval of twelve years between the publication, in 1842, of Kölliker's celebrated tract, entitled in Latin, "Observations on the first Genesis of Insects," and Zaddach's "Researches on the Development and Structure of Articulated Animals; Part I. The Development of Phryganidan Eggs," which appeared in 1854. Then followed Leuckart's "Propagation and Development of the Pupipara, from observations on Melophagus ovinus;" Huxley's article in the Linnæan Transactions, on the "Reproduction and Morphology of Aphis;" and Lubbock's essay on the "Ova and Pseudova of Insects," in the London Philosophical Transactions for 1859. Claparède, in 1862, published his splendid and beautifully illustrated prize essay on the "Evolution of Spiders," and a year after Weismann followed with a succession of brilliant works on the "Embryology and Anatomy of Diptera," which are in many respects the most important essays on the embryology of the hexapodous insects that have yet appeared, while the illustrations, very copious and detailed, are the most elaborate we have yet seen. Of great importance also is Mecznikow's "Researches on the

Embryology of the Hemiptera (Aphis, Aspidiotus, Corixa), and Simulium, and the viviparous Cecidomyian larva," which were printed in Siebold and Kölliker's Journal, in 1866.

At the meeting of the American Association, in August, 1867, the writer presented a paper on the Development of a Dragon-fly (Diplax), an illustrated abstract of which appeared in the NATURALIST, vol 1, p. 676. His studies did not embrace the earliest changes in the egg, but only those observed after the rudiments of the head and appendages appeared. In 1868 Dr. Alex. Brandt presented to the Imperial Academy of Sciences, of St. Petersburgh, a paper entitled "Contributions to the Developmental History of the Libellulidæ (Calopteryx and Agrion) and Hemiptera, with especial reference to the Embryonal integument" (blastoderm). With these two papers, the latter relating to the earliest changes in the eggs of Dragon-flies, and the former to the later stages in the life of the embryo, we have quite a complete account of the evolution of this remarkable family of insects. Dr. Brandt also gives the developmental history of certain Hemiptera (Corixa, Hydrometra, Lecanium and Aphis), and shows the remarkable identity in the embryology of these insects with the neuropterous insects mentioned above. A few other articles have appeared by Newport, Van Beneden, and others. We have already in the present volume of the NATURALIST, quoted from the abstract of Robins' paper on the "Development of Mites," quoted from the "Comptes Rendus" of the French Academy.

We would now notice the last work on the embryology of insects, that of Claparède, entitled "Studies on the Acarina," and published in Siebold and Kölliker's Journal of Scientific Zoölogy, during the present year. Claparède has observed in Atax Bonzi, which is a parasite on the gills of fresh-water mussels, that out of the originally laid egg (Pl. 8, fig. 3, embryo of *Tyroglyphus siro*, which closely resembles the earliest stages of the embryo of Atax; *vt*, yolk; *md*, mandibles; *mx*, maxillæ; p'–p''', legs. Fig. 4, front view of the same; R, beak; *p*, maxillæ), not a larva, but an egg-shaped form hatches, which he calls a "deutovum." (Pl. 8, fig. 1, bursting of the egg-shell into two halves, *mo*, on the day the deutovum, *dm*, hatches out; *md*, mandibles; *mx*, maxillæ; p''', third pair of legs; *lh*, body cavity; *sp*, common beginning of the alimentary canal and nervous system; *amb*, hæmabœba, amœba-like bodies, which represent the blood corpuscles; there being no circulation of the blood, the movements of the hæmabœba constitute a vicarious circulation. Fig. 2, the deutovum free from the first egg-shell; lettering same as in Fig. 1; *oc*, rudiments of the simple eyes; R, beak, *h h'*, rudimentary stomach and liver). From this deutovum (which is not the "amnion" of insects), is developed a six-footed larva. This larva passes into an eight-footed form, the "second larva" (the "nymph" or pupa, of Dujardin and Robin) which transforms into the adult mite. The pupa differs from the adult in having longer feet, and four instead of ten genital clasping cups, the latter being the usual number in the adult.

The larvæ are elongated oval, with six long legs and four ocelli. They swarm over the gills of the mussel they are living on for a short time, and then bore into the substance of the gill to undergo their next transformation. Here the young mite increases in size, and becomes round. The tissues soften, those of the different organs not being so well marked as in the first larval stage. The limbs are short and much larger than before, the whole animal assuming an embryo-like appearance, and moving about like a rounded mass in its enclosure. Indeed is this process not (though Claparède does not say so) a histolysis of the former larval tissues, and the formation of a new body, as in the change of the six-footed insect beneath the larva skin where the pupa is formed? A new set of limbs grow out, this time there being four instead of three pairs of legs, while the old larval skin is still embraced within the membrane containing the second larval round mass. Soon the body is perfected, and the pupa, as we may properly call it, slips out of the larval membrane.

The "second larva" after some time undergoes another change; the limbs grow much shorter and are folded beneath the body, the animal being immovable, while the whole body assumes a broadly ovate form, and looks like an embryo just before hatching, but still lying within the egg. This may also be comparable with the formation of the adult fly within the puparium. (Compare Weismann's account of this process in Musca, in our "Guide to the Study of Insects," pp. 63, 64.) This period seems to be an exact repetition of the histolysis, and the formation of new tissues for the building up of a new body, which preceded the pupal stage, while the adult mite slips out of its pupal membrane, just as the pupal mite throws off its larval membrane, like an adult butterfly, or fly, emerging from its pupal membrane.

Thus the mites, at least several species, pass through a series of metamorphoses similar to those of such insects as have a complete metamorphosis (except that the Acarian pupa is active), while the absence of such metamorphosis in the spiders, is paralleled by the incomplete metamorphosis of the orthoptera and many neuroptera, which reach adult life by simple moultings of the skin.

In the genus Myobia there is not only a deutovum, besides the original egg, but also a *tritovum-stage*. The eggs of this mite are long, oval and conical at the posterior end. The embryo with the rudiments of limbs is represented by Fig. 5 of Plate 8. The little tubercles *md* and *mx*, represent the mandibles and maxillæ, while the three pairs of legs, $p'p''p'''$, bud out from the middle of the body: *lc* represents the head-plate. The maxillæ and mandibles finally unite to form a beak (*u*, Fig. 6) and the three pairs of feet ($p'p''p'''$) are folded along the median line of the body. The farther development of the embryo is now for a time arrested, and a peculiar tooth-like process (Fig. 7, *d*.) is developed. Claparède thinks that by means of this the anterior end of the egg-shell is cut off, and the embryo protrudes through, when (as in Fig. 7) it is seen to be surrounded by a new membrane, the deutovum (*dt*), equivalent to that of Atax. The

front pair of legs (p') have grown larger and stand out in front and on each side of the beak (R). The growing embryo again forces off the anterior end of its deutovum, and the oval end of the egg protrudes through, and is surrounded by another membrane. This is the *tritovum*. The embryo is now surrounded by the membrane of the tritovum, and also by the deutovular membrane and the original egg-shell, the last two having lost a small portion of the anterior end. During the tritovum-stage the fore pair of feet become curved in like claws, and the beak sinks down into the body.

Now the six-footed larva (Fig. 8) breaks through the shell, and closely resembles the adult (Pl. 8, Fig. 9). The first pair of feet modified for grasping the hairs of the field mouse, on which it is a parasite, take the place of the maxillæ, which have been arrested in their development, and the mandibles (*pr*) assume a style-like form. After one or more moultings of the skin, a fourth pair of feet (p'''') are acquired, and the adult form results, which the author considers as the type of a new family of Acarina. Claparède also suggests the affinity of Myobia to the Tardigrades (Echiniscus and Lydella,) especially from the study of the structure of the style-like mandibles and their supports. We feel convinced, from the study of Claparède's figures and descriptions, that this comparison is very significant, and this has led us to consider the Tardigrades as a family of mites, related to Myobia and Demodex.

The developmental history of Tetranychus is fully given, and he shows that, in regard especially to the mouth-parts, it passes through an Ixodes-like stage, the beak of the young closely resembling that of the tick. Also, in less complete form, that of a species of Tyroglyphus, in which he shows that the genus Hypopus, which strongly resembles Gamasus, is the male state of several species of Tyroglyphus. Such species with Gamasus-like males he states should be separated from the true Tyroglyphi under the name of Hypopus. He also gives the developmental history of Hoplophora. Since many Oribatidæ pass through an Acarus-like stage, he, with Gervais, places them next to the Acaridæ. He likewise describes *Myocoptes musculinus* (Koch) a form allied to our *Dermaleichus pici-pubescentis* (see Pl. 6, Figs. 1, 2, 3.) The work is very fully illustrated with ten beautifully drawn folding plates.

The author concludes with a short chapter entitled "Für Darwin." He considers that many points in the organization of the mites, in relation to their modes of life, confirm the truth of Darwin's theory of the origin of species. He cites the structure of the clasping organs attached to the legs, by which they are enabled to grasp the hairs of their host, and instances the alternation in form and position of the first pair of legs in Myobia, and their wonderful adaptation for grasping the hairs of the mice on which they live. He also cites the case of a species of Hypopus, in which, as described by Dujardin, there is, on the hinder edge of the abdomen, two scoop-like lips by which they cling to the hairs of their host.

THE GENERATIONS OF WORMS.*—Our readers are already familiar with the strange alternations of generation observed in many of the lower intestinal worms. Like successions of forms differing remarkably from the parent, probably occur even in the most highly organized anneiids. In the present Journal Dr. Malmgren, known by his elaborate works on the Annelids of the Northern and Arctic Seas, cites what he supposes to be another case, referring the species of "Heteronereis" (which had been considered by earlier observers as a good genus, and may be found swimming on the surface of the ocean, as we have observed it on the coast of Labrador), to certain species of the genus Nereis, which live in the mud or swim at the bottom. The actual connection has not been yet traced, but the author is strongly of the opinion that it will be found that the Nereids are the parents of the Heteronereis, and also of the species of Iphinereis, another genus allied to the former.

FLORIDA AND THE SOUTH.†—Travellers and naturalists in Florida will find in this little book a reliable guide to its hunting grounds and sanitary retreats, by one already well known as a writer on the history of Florida. The traveller should also take with him the articles on the shell-mounds of Florida, by Prof. Wyman, published in our second volume, and those of Mr. Stearns, which are now appearing in the NATURALIST.

ANNALS OF BEE CULTURE.‡—We should judge that this annual was a very timely production. The articles, mostly written by the Editor, are such as must interest and instruct bee-keepers, and we gladly hail every publication which has for its aim the improvement of the art and science of bee-keeping. The Editor proposes to issue another annual early in 1870.

NATURAL HISTORY MISCELLANY.

BOTANY.

TENDENCY OF FLORAL ORGANS TO EXCHANGE OFFICES. I have before me a curious instance of the tendency which floral organs have to exchange offices. It is a staminate spike of corn well developed, and of normal growth for some five inches from its insertion on the stem, but bearing on its apex a well defined little ear of grain, as regular in structure as those which were born in their accustomed place. I do not know how common this may be, but I never before chanced to see it.—C. J. S.

* Siebold and Kolliker's Journal of Scientific Zoology, 1869.

† A Guide-book of Florida and the South, for Tourists, Invalids, and Emigrants; with a map of the St. John River. By D. G. Brenton, M. D. Philadelphia, 1869. 12mo, pp. 136. Penn. Publishing Co. $1.00.

‡ Annals of Bee Culture for 1869. By D. L. Adair, Editor. Louisville, Ky. 8vo, pp. 57.

Herbarium of the late Dr. Walker-Arnott.—The herbarium belonging to the late Dr. Walker-Arnott has, since his death, been acquired by the Glasgow University. Included in this is his magnificent collection of Diatomaceæ, which is contained in three large cabinets, and consists of fully ten thousand specimens, all mounted upon glass slides, ready for examination by means of the microscope. The specimens put up in tubes, from which slides can be prepared, will most likely be acquired by Dr. Eulenstein, the well known German diatomist, who will thus be enabled to push forward, it is to be hoped, the new edition of Pritchard's Infusoria, upon which he has been for some time engaged. The herbarium is a very large one, being contained in twenty cabinets, each of which holds at least four thousand specimens. The botanical library goes with the herbarium, and thus will be stored in a safe resting-place, the results of the labor of fifty years in the life of this eminent botanist. —A. M. Edwards.

New Locality of Aspidium aculeatum (L.) Sw. This fern, though widely distributed over the globe, is rare in the United States, being confined to a few mountains and high valleys in New England and New York. It has been collected in the White Mountains of New Hampshire, near the summit of Mt. Willoughby, and in the Notch at the north-eastern base of Mt. Mansfield, Vermont—and among the Adirondack mountains, N. Y. To these localities we may now add "Stony Clove," Catskill Mountains, N. Y., — where the writer found it in August of this year, growing abundantly, under conditions very similar to those of Mt. Mansfield Notch. This locality is one hundred and forty miles farther south than any previously known in our country. — John H. Redfield, *Phila.*

ZOÖLOGY.

A Remarkable Echinoderm. — At the meeting of the Scandinavian Naturalists at Christiania in 1868, Professor Lovén laid before the Zoölogical section the figures and description of a very remarkable Echinoderm from the Torres Straits (off Cape York), termed *Hyponome Sarsi.* It forms, in a new and very unexpected manner, a link between the palæozoic and the recent animal life. It is, strange to say, most nearly allied to Cystidea, especially to Agelacrinus, and will, no doubt, when its anatomy shall be known, give us a full clue to the comprehension of this enigmatic zoölogical type. The animal (which appears not to have lived fastened to the bottom of the sea) resembles a star-fish, with fine short and thick, but dichotomously branching arms; it had no stem. Five ambulacral furrows are present, giving off branches to the branches of the arms, and farther to several small club-like swellings of the skin, covering the superior, or ventral surface; but only these terminal or distal parts of the ambulacral furrows are open; in the rest of their course towards the centre of the disk they are covered up or converted into

vaulted galleries, converging towards the central, but exteriorly *invisible* mouth. This covering up of the ambulacral furrows was effected by means of the limiting plates joining each other altogether from both sides; but that the food is picked up in the open parts and conveyed to the invisible mouth, is demonstrated by the fact that small heaps of small crustacea and other minute animals were found in them. With the exception of a smooth, triangular space on the back, with a group of small pores in the centre (we do not yet know whether these pores are genital outlets or perhaps play the part of a "madreporite") the whole dorsal and ventral surface is covered with small irregular calcareous plates; but in one of the interradial areas of the ventral surface arises an anal tube, or "proboscis," evidently quite analogous to the anal tube of Antedon, Pentacrinus, Rhizocrinus (and all other recent crinoids, with the exception of the little known Holopus) to the "pyramid" of Agelacrinus, Caryocrinus and Cystidea generally, and to the short or long proboscis of most palæozoic Crinoids, with a hard, tessellated cover of the calyx. It has been a great puzzle, that a mouth, separate from the anal "proboscis" could not be detected in most of the palæozoic Crinoids, now we know where to find it. Mr. Billing's discovery of subterminal ambulacral channels, or vaulted galleries, situated quite below the unbroken perisome, and radiating from the arms towards the central part of the disc, shows clearly, when elucidated by the analogy of the half open, half closed ambulacral channels of Hyponome, that the mouth in these old sea lilies was *internal, hidden and invisible*, and that the "proboscis" had nothing to do with it, but was simply the excretory part of the digestive system, as pointed out already in 1866 by Dr. Schultze, in his excellent Monograph of the Echinoderms of the Eifel. — Dr. C. F. Lütken, Copenhagen.

The Tennessee Warbler. — I was much surprised at the statement of Mr. Boardman in the June number of the Naturalist, that the Tennessee Warbler is a common species in Maine during the spring. In the article to which he refers, I stated that it was rare in New England, rather on the authority of writers on ornithology than as the result of my own observations. Audubon says that the Tennessee Warbler is rare, and that it extends northward only as far as New York. Wilson met with but three specimens. Nuttall makes no mention of it among the birds of New England. Girard never met with it on Long Island; and De Kay says it is rare in the State of New York. I, myself, have never met with more than two specimens.

It is a very curious fact that this bird should be so rare in New York, and yet so abundant in Maine. All the other Warblers that enter New England in the spring pass through New York and New Jersey, where for a few days they are as abundant as they afterwards are in the New England States. Either the Tennessee Warbler must migrate with extraordinary rapidity, thus escaping detection, or else it must pursue a more westerly route than the other warblers, turning eastward only when it has journeyed a considerable distance north.—T. M Trippe, *Orange, N.Y.*

GOLDEN-WINGED WARBLER.—Dr. Coues in his "List of the Birds of New England" gives this bird as a "very rare summer visitant to the more southern portions. On page 214 of Mr. Samuels' work, I stated that I had found it occurring sparingly in May for several seasons. Since writing what I did I have observed the Golden-winged Warbler more plenty than ever, and as late as the middle of June, and in the same locality early in August with young. I felt, therefore, quite confident that it breeds here. This June (1869) Mr. J. C. Maynard has had the rare good fortune to find a nest and four eggs. Mr. Allen tells me that since publishing his list he has found it at Springfield in summer, and Mr. Jillson, of Hudson, writes me that it breeds in his locality, though I am not aware that he has actually obtained the nest. I wrongly stated in my letter to Mr. Samuels that this species, probably, proceeded North to breed. From my observations and knowledge of the bird at that time, I supposed it did so. Probably this state is about its northern limit on the Atlantic.—H. A. PURDIE, *West Newton, Mass., June*, 1869.

CORAL SNAKES.—A number of species of very different genera are confounded under this name by the inhabitants of tropical America. Their general appearance is attractive, being banded with red, black, and white. Some of them belonging to the genus *Elaps* are poisonous, though some of these are very mild and indisposed to bite. Others, belonging to the genera *Pliocercus, Erythrolamprus, Ophibolus, Oxyrrhopus,* etc., are quite harmless, but can only be distinguished from species of *Elaps* by a careful examination of the scales and teeth. The mimetic analogy presented by these species with species of *Elaps*, according to Prof. Cope, is very remarkable.

During a stay of a few days in Greytown, Nicaragua, an alcoholic specimen of a snake, called a "coral" snake and regarded as extremely poisonous, was added to our collection by a resident. Under the direction of Mr. Robert Kennicott, the naturalist in charge of our party, who had devoted several years to the study of reptiles, we examined the snake in question, compared it with other snakes known to be poisonous, and were fully satisfied that it was quite harmless notwithstanding the absurd stories which were related of it. I afterward brought in one of these snakes alive, and after examining the dentition with Mr. Kennicott, and confirming our previous opinion as to its harmlessness, it was preserved in alcohol. Asking Mr. K. what the species was, he answered that it belonged doubtfully in the genus *Elaps*, as it was a harmless snake, and was perhaps a new species of his own.* Not being a herpetologist, in a recent article in the NATURALIST I adverted to the circumstance, and used Mr. Kennicott's name as he wrote it in my note-book. An esteemed correspondent, in some remarks about the inadvisibility of handling unknown snakes reported to be poisonous, which I thoroughly

* I have since been informed on good authority that the species to which he referred it is confined to *Sonora*.

agree with in general, rather hastily referred the case in question to the same category. A second glance would hardly have seen either bravado or foolhardiness in the capture of a snake of which an alcoholic specimen just previously examined, had given incontrovertible proofs of its utter harmlessness.—W. H. DALL.

THE BLACK VULTURE IN MAINE.—I had sent me (shot in this neighborhood) a good specimen of the Black Vulture (*Cathartes atratus*), the first one I ever knew so far east; and also a fine specimen of the Purple Gallinule (*Gallinula martinica*).—G. A. BOARDMAN, *Calais, Me.*

MICROSCOPY.

METHOD OF PRESERVING ANIMAL SPECIMENS FOR FINE DISSECTION.—Microscopists will read with interest a very simple method of preserving animal specimens for fine dissection. It is described by Dr. Alcock. The advantages of the plan are very perfect preservation; no necessity for closing up, so that the specimen cannot be got at; no fear of losing a valuable dissection from accidental evaporation, as when spirit is used; lastly, cheapness. The method adopted is to prepare a saturated solution of corrosive sublimate in alcohol, and when a dissection in water is in progress, a small quantity—half a teaspoonful—of the solution is to be added from day to day if the slightest appearance of putrefaction is observed, but no more of it is used than is absolutely necessary; and by the time the dissection is completed, the specimen has become imperishable from the union of the corrosive sublimate with the tissues, and it may then be kept in pure water, either open or mounted, in the usual way.—*Quarterly Journal of Science, London.*

GEOLOGY.

THE EOZOÖN IN ESSEX COUNTY. The remains of this, the oldest form of animal life thus far discovered on our globe, and found in the azoic [Laurentian] rocks of Ottawa, Canada, have, it is confidently believed, been within a few days detected in the serpentine of our "Devil's Den." The animal, if it may be so called, has been arranged by naturalists among the rhizopods, and would seem to have been a jelly-like living mass, spreading out on the bottom of the sea, capable of secreting calcareous partitions, and thus forming small chambers or cells, the interior of which has become filled by serpentine, which was deposited from the waters of the ocean, and took the place of the decomposing animated mass. This discovery, resulting from a visit of Prof. T. Sterry Hunt of Montreal to our neighborhood, will excite new interest in our limestone and serpentine quarry among geologists, and throw additional light upon the character and age of the rocks in this region.

Mr. Edwin Bicknell (Preparator of the Peabody Academy of Science, Salem), has, by a careful microscopic comparison of a specimen of Eo-

zoön, furnished by Dr. Dawson of Montreal, with one from the Devil's Den, fully established the discovery. In a letter from Mr. Bicknell which we have seen, he says — "I have no hesitation in saying, if the Canadian specimen is Eozoön, the Newburyport one is also." — H. C. PERKINS.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Prof. A. E. VERRILL read a paper "On the comparison of the Coral Faunæ of the Atlantic and Pacific Coasts of the Isthmus of Darien, as bearing on the supposed former connection between the two Oceans. The question of a former connection between the Atlantic and Pacific, across the Isthmus of Darien, has very important bearings both in Zoölogy and Geology. With many geologists it has been a favorite and convenient theory to account for climatic changes in Europe by a depression of the Isthmus sufficient to allow the Gulf Stream to flow into the Pacific. Admitting a connection it does not necessarily follow that the Gulf Stream would flow into the Pacific, for a current in the opposite direction might result, while with a shallow channel, owing to the difference in the tides (twenty-two feet at Panama and about two at Aspinwall) it is probable that the flow would be first one way and then the other. The evidence from Geology is quite insufficient to establish the theory, and the facts cited have in most cases proved unreliable. The zoölogical evidence is mainly the occurrence of identical and closely allied species on both sides. Thus of mollusca about fifteen hundred species occur upon the west tropical coast, of which Dr. P. P. Carpenter enumerates thirty-five species as identical upon the two coasts; thirty-four as doubtful, but possibly identical; and sixty-seven that are closely allied, but evidently distinct. Since his lists were published other species have been added to them, among which *Paphrydia bullata*, a common West Indian shell, which has recently been received with *Codakia tigerina* from the Gulf of California, by the Museum of Yale College. Dr. Stimpson admits eight or ten species of Crustacea as identical, and although Mr. Ordway has separated the *Callinectes* of the west coast satisfactorily, there are other identical species among the large collections recently received from that coast by the Museum of Yale College, through Mr. Bradley and others, so that of about 150 species of Decapods, ten or twelve appear to be perfectly identical, not showing even varietal differences. Among 173 species of marine fishes from both coasts Dr. Günther regards fifty-seven as identical. Mr. Gill would, however, separate some of these forms, but the general result would still remain the same, since certain species do not show even varietal differences. The Echinoderms of the two coasts have been examined and tabulated by the author* and gave very different results, for of eighty-two species found on the west coast none

*Transactions of the Connecticut Academy, Vol. I, p. 339, 1867.

are identical with those of the Atlantic, unless two Holothurians which may be regarded as doubtful, though considered the same by Selenka. But at least fifty of the species are analogous, or correspond with similar Atlantic species.

A careful comparative study of the corals and Polyps of the Atlantic, and extensive, and, for the shallow water forms, nearly complete collections from various localities on the Pacific coast, give quite unexpected results, since no species are found to be identical, while even the genera and families show remarkable contrasts. Thus the numerous genera and families of reef-building corals, so abundant on the Atlantic side, are wholly wanting on the Pacific, with the exception of Porites, which is represented by three or four small species. Massive Astræans, Mæandrina, Diploria, Manicina, Colpophyllia, Agaricia, Siderastræa, Oculina, Madrepora, Millepora, are wholly unknown in the Panama fauna. But Pocillipora, Montipora, and Pavonia, genera unknown on the Atlantic side, are represented, the last by two gigantic species. Among the Halcyonoid Polyps we find an equal contrast, for Eunicea, Plexaura, Plexaurella, Pterogorgia and many other very common Atlantic genera are unknown on the Pacific side, where they are replaced by numerous species of Psammogorgia, Litigorgia, and Eugorgia, which are eminently characteristic of that coast.

The genus Muricea is very common, and represented by seventeen species, while on the Atlantic side only four species are usually admitted, all of which are so different as scarcely to be regarded as analogous species. The genus Renilla is found on both coasts. Among the Actinians we find greater resemblances, but as yet no identical species.

From these facts we may legitimately conclude that no very extensive or deep connection, sufficient to alter the course of oceanic currents, can have existed since the coasts have been inhabited by the existing species, otherwise a greater admixture must have taken place. A narrow or shallow channel of communication would probably account for all identical species yet observed, but at what period it may have existed is still another question. The occurrence of certain Atlantic species in the Gulf of California and not at Panama (*Codakia tigerina*, *Paphrydia bullata*); the evidence of a uniform and long continued flow of the Gulf Stream, to be derived from the growth of the extensive coral reefs of the Bermudas, and the southern extension of Florida with its numerous ancient reefs of coral rock, one of which occurs even as far north as Tampa Bay, made up of existing species, show that the present coral faunæ are of immense antiquity, and also that the specific characters are wonderfully persistent. The peculiar relations between the two faunæ manifested by the numerous analogous but distinct species and genera are probably facts of a different order, and will require a different solution, for even if we adopt a developmental theory we shall doubtless be compelled to refer the period of separation to a period far more ancient than that at which the few identical species became separated, and to admit a far more extensive and prolonged connection between the two oceans.

Mr. G. L. VOSE read a paper entitled "Compression as an agent in Geological Metamorphism; with Illustrations of Distorted Pebbles in Conglomerates." The metamorphic regions are compressed regions. Compression produces heat, and changes not only the outward form but also the mineral nature of the rocks.

Prof. VERRILL, in his paper "On American Phyllopod Crustacea," gave an account of the habits, etc., of our species of Branchipus and Artemia. Of the latter he has obtained two new species, one from Mono Lake, California, and the other in numerous individuals from tubs of salt water on a railroad bridge near New Haven. These tubs, filled from the salt marsh, have become very salt by evaporation in the sun, thus giving the ordinary conditions for the development of this beautiful genus.

In her paper "On the Plumage of the Tern," Miss. G. A. LEWIS described the structure of the feather, illustrating her descriptions with several microscopic drawings.

Miss. LEWIS in her "Thoughts on the Structure of the Animal Kingdom," says, from the radiate to man there does not appear to be any direct line of connection from the higher members of one group to the lower members of the next; on the contrary the nearest allies are found near the origin of the groups. At such points there may be animals combining characters which afterward become specialized in several groups; as there may be some which rise above, whilst others sink below the grade common to the group. A succession of such points marking the origin of the invertebrate branches and the vertebrate classes, might be considered as a spiral around the *axial line* of the animal kingdom. From their respective points of origin the branches and classes proceed, each on its own road towards the perfection of its types, but *not* necessarily turned toward the branch or class above. It is probably the same line perceived by Haeckel, and to which he refers as "commencing with Amphioxus, and proceeding through the Lampreys and the extinct allies of the Sharks to the Lepidosirens, thence through Proteus and its congeners to the Tritons and Salamanders, and thus to the Monotremata (Ornithorhyncus). The line passes through the Marsupials, the Lemurs, the old world Monkeys (Semnopithecus) and the Anthropoid Apes (Orang and Gorilla)."

The axial line was distinguished by the writer in the summer of 1867, and was alluded to in a little pamphlet published in the spring of 1868. She would begin with the lower radiates, pass through the earliest Crinoids, so reaching the origin of the Molluscous branch, ascend through the extinct Cephalopods, and pass the Articulates through the early worms and trilobites. She considered the three great invertebrate branches as lying horizontally at the base of the vertebrate axis. From thence she would pass through each vertebrate group, as it presented itself in the geologic period in which it took its rise, and thus reach man at whatever time he appeared in the Quaternary period. With the production of brain the animal rises from the horizontal towards the polar position of man. There are, however, some very curious exceptions to

this general law. Along the axial line there is a tendency to return to the horizontal in some groups, with an extreme rise towards the polar in others. Between these extremes the group holds its proper level in proportion to the development of brain. Thus there comes to be one line of progression upwards towards man, and many outwards towards the periphery of the branching classes. In the vertebrate branch the birds hold an intermediate position, and, intelligently studied, throw a flood of light backward and forward over the animal world. Taking their rise between the reptile and the mammal they combine with the ornithic, both reptilian and mammalian characters, but the finest development of brain, with its accompanying delicacy of organization, exists at the extremities of the ornithic branch where the true bird type is found, purified, so to speak, of both reptilian and mammalian tendencies. Here we find the songsters and those birds which are most responsive to the influence of man. The axial line for the class of birds, like that of the animal kingdom, is marked by the carrying forward of a mingled stream. It is only near the terminal branches that the pure bird-like forms, the blossoms of the type are found.

The foot in Archæopteryx anticipates that found in the highest groups of birds, and peculiarities of structure drawn from the mammal are not wholly lost until the family of the parrots is passed. Here a rudiment of the diaphragm is found. In the animal kingdom the uncreated man, existing only in the conception of Deity, lifts the whole animal creation and holds it at a higher level.

Mr. MEEHAN also said, in regard to Cassia, that physiologically the leaf was considered the parent of the axillary bud,—and that "adventitious" buds was a term created to account for buds not axillary. The absorption of the bud by Cassia, and the existence of buds, one above another, in other plants, without connection with the petiole, and with the strongest *one the farthest removed from the petiole*, indicated that the leaf was *rather an enemy than an aid to bud development;* and that the classes of *axillary* and *adventitious* buds, had no physiological law to separate them.

MR. LEWIS H. MORGAN gave a conjectural explanation of the Uses of the Embankments of the Mound Builders. Mr. Morgan considered them as the bases (built for defensive purposes) of the *pueblos* or villages of that race of men.

MR. PORTER C. BLISS then read a paper upon a New Classification of the South American Indians upon the basis of Philology. Mr. Bliss gave as one of the results of several years of travel and investigation among the aborigines of the Argentine Republic, Bolivia, Paraguay, Brazil, etc., the discovery that the number of stock languages within those regions has been exaggerated tenfold, and that there are, instead of one hundred and fifty or more as has been loosely stated by the Jesuits and other later writers, but twelve or thirteen stock languages in the Southern half of South America. Of all these he had collected vocabularies.

Mr. Bliss proceeded to point out on a large map of South America, the

localities of each of the tribes mentioned, beginning with the Fuegians, and passing to the two races of Patagonians, the Araucarians of Chile, whom he identified with the Pehuenches, Huilliches and Aucas of the Pampas of Buenos Ayres, the Abipones, Tobas, Mocobis, Ocoles, Mataguayos and Machicuys of the Gran Chaco or region between Paraguay and Bolivia.

He then described the Guaranis and Payaguas of Paraguay, the Atacamas, Quichuas, Aymaras, Chiriguanos and Chiquuitians of Bolivia, and giving many facts respecting the character of their various languages. He adverted to the extensive area of the Guarani tongue, which extends substantially from the La Plata to the Oronoco, embracing a great portion of Brazil and most of the basin of the Amazon. He stated that he had found the Quichua language spoken in the centre of the Argentine Republic, in the province of Santiago del Estero, eight hundred miles from the nearest point in Bolivia where the same language is now spoken. Consequently Mr. Bliss considered this province to have been an outlying colony of the empire of the Incas.

The languages of the Indians of the Chaco are extremely meagre, and none of them exceeds about a thousand root-words.

Mr. Bliss stated that the principle of reduplication was largely concerned in the formation of the language of the Incas, and that he had collected in Bolivia more than three hundred geographical names formed in this way, as Mocomoco, Coro-coro, Quilli-quilli, and cited as a double reduplication the name of the famous lake Ti-ti-ca-ca. He stated that within two hundred years the Guarani language had undergone an almost complete change, so that instead of being now, as formerly, made up from monosyllabic radicals, it is quite as polysyllabic as most other Indian tongues.

Mr. E. S. Morse's paper "On the Early Stages of Brachiopods" was reported in the September number.

Prof. O. C. Marsh read a paper on the "Discovery of the Remains of the Horse among the Ancient Ruins of Central America," the title of which was inadvertently omitted in our list of papers presented to the Association.

ANSWERS TO CORRESPONDENTS.

L. H. P. — The name of your "moss" is *Mastigobrium trilobatum* Nees., and the bit of "light wood" is stained by the *Peziza æruginosa*, a verdigris-green colored fungus not uncommon in woods. — J. L. R.

J. P. S., Glen Falls, New York.—A quotation from Agassiz's Method of Study in Natural History, p. 276, will give you the desired information regarding the egg cases of the cockle you speak of. "No one who has ever walked across sand beaches in summer can have failed to remark what the children call 'sand saucers.' The name is not a bad one, with the exception that the saucer lacks a bottom; but the form of these circular bands of sand is certainly very like a saucer with the bottom knocked out. Hold one of them against the light and you will see that it is composed of countless transparent spheres, each of the size of a small pin's head. These are the eggs of our common Natica, or Sea-snail. Any one who remembers the outline of this shell will easily understand the process by which its eggs are left lying on the beach in the form I have described. They are laid in the shape of a broad, short ribbon, pressed between the mantle of the animal and its shell, and, passing out, they cover the exterior of the shell, over which they are rolled up with a kind of glutinous envelope,—for the eggs are held together by a soft glutinous substance. Thus surrounded, the Natica, whose habit it is to burrow under the surface of the beach, soon covers itself with sand, the particles of which, in contact with the glutinous substance of the eggs, quickly forms a cement that binds the whole together in a kind of paste. When consolidated it drops off from the shell, having taken the mould of its form, as it were, and retaining the curve which distinguishes the Natica. Although these saucers look perfectly round, it will be found that the edges are not soldered together, but are simply lapped one over the other. Every one of the thousand little spheres crowded into such a circle of sand contains an egg."

W. L. T., Minneapolis, Minn.—The Philadelphia Vireo (*Vireosylvia Philadelphica* Cassin), taken by you at Minneapolis, and respecting whose history you enquire, is a species not yet very well known. It was first described by Mr. Cassin, from a specimen taken near Philadelphia, in 1851. Seven years later, when it was redescribed by Professor Baird; it was known also from Cleveland, Ohio, and Dane County, Wisconsin. In 1866, when mentioned again by Professor Baird, additional specimens had been received at the Smithsonian Institution from Maine, Moose Factory, H. B. T., and Guatemala. But a single specimen is thus far known from New England, taken by Professor C. E. Hamlin, at Waterville, Maine; it seems to be more common in the interior. In May, 1867, I found it one of the most common Vireos in Cook County, Illinois. It is hence known to have a wide distribution. In habits, as in size and general appearance, it greatly resembles the well known Warbling Vireo (*Vireosylvia gilva* Cass.). For descriptions of this species see Proc. Phil. Acad. Nat. Sci., vol. v, p. 153; Baird's Birds of North America, p. 335; Baird's Review of American Birds, p. 341.

The Yellow-bellied Flycatcher (*Empidonax flaviventris* Baird), respecting which you make a similar inquiry, is also a species imperfectly known. First described by Drs. S. F. and W. M. Baird, in 1843, from specimens taken in Pennsylvania, its range has since been found to extend throughout eastern North America, if not throughout the continent, but it appears to be nowhere very common. Its retiring habits, and close resemblance, at a little distance, to the more common species of its genus doubtless tend greatly to render its capture so relatively unfrequent. It shows a marked predilection for thickets and wooded situations. In Massachusetts it is more or less common in May, and towards the close of summer, but I am not aware that it has been seen here in the breeding season, although its breeding range is known to extend from the District of Columbia to Labrador. Its rather few but somewhat pleasing notes have been deemed by some to be worthy of being called a song. It is fully described in the later general works on North American Birds.—J. A. A.

BOOKS RECEIVED.

Sketch of the Life of Professor Chester Dewey. By M. B. Anderson. Albany, 1869. 8vo, pp. 11.

Contributions from the Sheffield Laboratory of Yale College. xx. *On Durangite a Fluo-Arseniate from Durango in Mexico.* By G. J. Brush. xxi. 8vo, pp. 4.

On the Meteoric Stone which fell December 5th, 1868, in Franklin Co., Alabama. By G. J. Brush. 8vo, pp. 4. *From the American Journal of Science and Arts, New Haven.*

American Bee Journal. Sept., Oct., 1869.

A Guide-Book of Florida and the South, for Tourists, Invalids and Emigrants, with a Map of the St. John River. By D. G. Brinton, M. D. Philadelphia, 1869. 12mo, pp. 136. Price $1.

Annals of Bee Culture for 1869, a Bee-Keeper's Year Book. D. L. Adair, Editor. Louisville, 1869. 8vo, pp. 57.

Popular Science Review. July. London.

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NOTES ON SOME OF THE RARER BIRDS OF MASSACHUSETTS.*

BY J. A. ALLEN.

THE Natural History of any portion of country cannot, of course, be too fully known; and the few ornithological notes at this time presented I feel sure will be acceptable to those who are interested in the study of the New England birds. While a large portion of the facts now communicated are of my own observing I am greatly indebted to the kindness of other persons for many of the interesting notes that, during the last five years, have been accumulating in my note-book. As the authorities upon which the observations not my own in the following pages are communicated are always indicated, I have here but to return thanks to my numerous ornithological correspondents and friends who have so generously favored me from time to time with their valuable contributions. Only by knowing thoroughly the fauna of a locality can the subsequent changes in it, induced by its becoming more densely settled, or by

* A supplement to a Catalogue of the Birds of Massachusetts, published five years since by the writer in the fourth volume of the Proceedings of the Essex Institute.

other causes, be traced. As is well known, the mammalian and bird faunæ of all the older settled parts of the United States are vastly different from what they were two hundred years ago. These changes consist mainly in the great decrease in numbers of the representatives of all the larger species, not a few of which are already extirpated where they were formerly common; a few of the smaller species of both classes have doubtless increased in numbers. Two causes operate unfavorably upon the larger ones; the disforesting of the country and the sporting propensities of the people, everything large enough to be shot, whether useful or otherwise, being considered as legitimate game. The former destroys the natural haunts of many species, while the latter destroys and drives away others that would otherwise remain. Many of the water-fowl that are now only transient visitors, as the Canada Goose, the several species of Merganser, Teals, Black Duck and Mallard, undoubtedly once bred in this State, as did also the Wild Turkey and the Prairie Hen. Several of the Gulls and probably some of the *Tringæ* have been driven, like the Ducks and Geese, to seek more northern breeding grounds. In comparatively recent times, geologically speaking, probably other causes, as climatic, have been operating to effect a gradual northward migration, in certain species at least. These changes are of great interest, not only generally, but in a scientific point of view, and we shall be able to trace them and their causes only by comparing, from time to time, exhaustive faunal records of the same localities.

In a district so little diversified as that portion of Massachusetts lying east of the Connecticut River, it is perhaps a little unexpected that marked discrepancies should occur in the observations made at adjoining localities by equally competent naturalists, in respect to the relative abundance of certain species. As every experienced observer must have noticed that the birds of passage, as many of the Warblers especially, vary greatly in numbers in different

years, and in the time occupied by them in passing a given locality, it is less surprising that at different points they should vary in abundance the same year. Among the birds that regularly breed in the district in question, there are some that are not equally common at all points. The Savannah Sparrow (*Passerculus savanna*), for instance, that along the coast and on the islands is one of the most common species of its family during the summer, is almost unknown at this season in the interior of the state, although a species that at different seasons of the year is found throughout nearly the whole continent. The Swamp Sparrow (*Melospiza palustris*) is likewise locally restricted, for while a common summer bird in many of the larger swamps in the eastern part of the state, as the Fresh Pond marshes in Cambridge, it has thus far escaped the detection of very expert observers in the interior and western part. The Yellow-winged Sparrow (*Coturniculus passerinus*) is likewise partial to peculiar localities, preferring apparently sandy plains and dry open pastures; while it is one of the most numerous summer sparrows about Springfield, on Cape Cod and at Nantucket, it is generally much more rarely observed in the eastern counties of the state, where at some localities it is deemed rare. The same remarks apply to other species, as the Solitary and White-eyed Vireos (*Lanivireo solitarius* and *Vireo Novœboracensis*), etc. The Prairie Warbler (*Dendrœca discolor*) is much more at home in old pastures partially grown up to barberries and cedars than elsewhere. The Song Sparrow (*Melospiza melodia*), generally so numerous everywhere, I found last year was one of the rarest sparrows on the islands and extreme coast border, where its relative, the Savannah, was so common.

Birds, as probably other animals, are not quite so invariable in their habits as has been commonly supposed, nor in the precise character of their notes and songs, or the situation and materials of which they compose their nests. Hence one should not rashly question the accounts given by usually

reliable authorities, because in particular instances they do not accord with their own observations. Neither should differences in habits, in song, etc., be taken as infallible evidence of a difference of species. It is well known that in Massachusetts the Brown Thrush (*Harporhynchus rufus*) is not uniform in the location of its nest, as about Springfield it almost invariably builds on the ground (in the many scores of nests that I have seen there I have met with but a single exception), while in other localities it as invariably places its nest a little above the ground in bushes. At Evanston, Ill., I once found one in an oak higher than I could reach; the locality, however, was swampy. How universally the Chipping Sparrow (*Spizella socialis*) breeds in trees, and generally at an elevation of several feet, is well known, but several authentic instances of this bird's nesting on the ground have come to my knowledge, one of which I myself discovered. Variations of this character in other species are of occasional occurrence, examples of which have doubtless been met with by every experienced collector.

The materials which birds select in the construction of their nests are well known to vary in different localities; the greater care exhibited by some species to secure a soft warm lining at the north that are much less precautious in this respect at the south, is already a recorded fact. Aside from this, the abundance of certain available materials occurring at only particular localities gives a marked character to the nests there built, which serves to distinguish them from those from other points. Some of the Thrushes, for instance, make use of a peculiar kind of moss at some localities that elsewhere, from its absence, are compelled to substitute for it fine grass or dry leaves. At Ipswich, on Cape Cod, and perhaps generally in the immediate vicinity of the sea, the Purple Grackles (*Quiscalus versicolor*) and Red-winged Blackbirds (*Agelæus phœniceus*), and in fact numerous other species, in building their nests often use little else than dry eel-grass or "sea-wrack," which results in

nest-structures widely different in appearance from those of their relatives residing in the interior. Every egg-collector is aware of the wide variations eggs of the same set may present, not only in the markings and in the tint of the ground color, but in size and form, and especially how wide these differences sometimes are in eggs of different birds of the same species. Also how different the behavior of the bird is when its nest is approached, in some cases the parents appearing almost utterly regardless of their own safety in their anxiety for their eggs or helpless young, while other parents of the same species quietly witness the robbing of their nest at a safe distance, and evince no extraordinary emotion. Those who have witnessed this, and have also watched the behavior of birds when undisturbed in their quiet retreats, will grant, I think, the same diversity of disposition and temperament to obtain among birds that is seen in man himself.

In respect to the songs of birds, who that has attentively listened to the singing of different Robins, Wood Thrushes or Purple Finches, has not detected great differences in the vocal powers of rival songsters of the same species? Different individuals of some species, especially among the Warblers, sing so differently that the expert field ornithologist is often puzzled to recognize them; especially is this so in the Black and White Creeper (*Mniotilta varia*) and the Black-throated Green Warbler (*Dendrœca virens*). But the strangest example of this sort I have noticed I think was the case of an Oriole (*Icterus Baltimore*) that I heard at Ipswich last season. So different were its notes from the common notes of the Baltimore that I failed entirely to refer them to that bird till I saw its author. So much, however, did it resemble a part of the song of the Western Meadow Lark (*Sturnella magna; S. neglecta* Aud.) that it at once not only recalled that bird, but the wild, grassy, gently undulating primitive prairie landscape where I had heard it, and with which the loud, clear, rich, mellow tones of this beau-

tiful songster so admirably harmonize. This bird I repeatedly recognized from the peculiarity of its notes during my several days stay at this locality. Aside from such unusual variations as this, which we may consider as accidental, birds of unquestionably the same species, as the Crow, the Blue Jay, the Towhe and others, at remote localites, as New England, Florida, Iowa, etc., often possess either general differences in their notes and song, easily recognizable, or certain notes at one of these localities never heard at the others, or an absence of some that are elsewhere familiar. This is perhaps not a strange fact, since it is now so well known that birds of the same species present certain well marked variations in size according to the latitude and elevation above the sea of the locality at which they were born, and that they vary considerably, though doubtless within a certain range, in many structural points at one and the same locality. In other words, since it is known that all the different individuals of a species are not exactly alike, as though all were cast in the same die, as some naturalists appear to have believed.

Certain irregularities in the breeding range of birds have also come to light. It is perhaps not remarkable that a pair of birds of species that regularly breed in northern New England should now and then pass the summer and rear their young in the southern part, as has been the case in certain known instances in the Snow Bird (*Junco hyemalis*), the Pine Finch (*Chrysomitris pinus*), and the White-throated Sparrow (*Zonotrichia albicollis*); but it is otherwise with the Snow Bunting (*Plectrophanes nivalis*), which rarely breeds south of Labrador, of which there is a single well authenticated instance of its breeding near Springfield. The casual visits of northern birds in winter, which we may suppose sometimes results from their being driven south by want of food or the severity of the season, are also less remarkable, it appears to me, than the occurrence here of southern species, as of the two Egrets, the Little Blue Heron

(*Florida cœrulea*) the Gallinules and other aquatic species, which never, so far as known (with one exception perhaps), breed so far north. In the latter case they are generally young birds that reach us towards fall in their chance wanderings.

It may here be added that the cause of the migration of our birds still offers an interesting field for investigation. Observers are of late noting that in the case of some northern species that reach us only occasionally in their winter migrations, young birds only are at first seen, but if the migration continues the older birds appear at a later date. But sometimes young birds only are seen. This frequently happens in the case of the Pine Grosbeak (*Pinicola eneucleator*). The cause of their visits is not always, it is evident, severe weather; the last named species appearing sometimes in November,—weeks before severe cold sets in—while at other times it is not seen at all during some of our severest winters. The probable cause is more frequently, doubtless, a short supply of food, as last winter was remarkable in this state for its mildness and for the great number of northern birds that then visited us. It has repeatedly been observed that on their first arrival these unusual visitors are generally very lean, but that they soon fatten; an argument in favor of the theory that their migration was compelled by a scarcity of food.

Probably fewer birds are actually permanently resident at a given locality than is commonly supposed, for species seen the whole year at the same locality, as the Blue Jay, the Titmouse, the Brown Creeper, and the Hairy and Downy Woodpecker, etc., in Massachusetts, are represented, not by the same, but by different sets of individuals, those seen here in summer being not those seen in winter, the species migrating north and south, *en masse*, with the change of season. We are generally cognizant of a migration in a given species only when the great "bird wave" sweeps entirely past us either to the north or south. Some species, how-

ever, seem actually fixed at all seasons, and are really essentially non-migratory, as the Spruce Partridge, and Quail (*Ortyx Virginianus*) are in New England. But only a small proportion, doubtless, of the so-called non-migratory birds at any given locality are really so.*

In connection with this topic of migration, the fact that some of the young or immature individuals of our marine birds, as the Herring Gull (*Larus argentatus*) and other species of that family, and several of the Tringæ, linger on our coast during summer, while the adult all retire northward, is one of some interest. Mature and strong birds only, in species that breed far to the north, evidently seek very high latitudes. Birds of the first year also appear to roam less widely than the older. In different species of the Gull family it is generally only the mature birds that in winter are seen far out at sea, though in the same latitudes the young may be numerous along the coast. All observant collectors are well aware of the fact that those birds that first reach us in the spring, of whatever species, are generally not only very appreciably larger, but brighter plumaged and in every way evidently more perfect birds than those that arrive later; and that in those species that go entirely to the north of us there is a much larger proportion of paler colored and immature birds, especially among the *Sylvicolidæ*, or warblers, towards the close of the migrating season than earlier. Hence the presence here of a few individuals in summer of species that usually go farther north is not always sufficient evidence that the species breeds with us.

In reference to the notes which follow, they may be considered as forming a supplement, as already stated in a foot note, to a "Catalogue of the Birds of Massachusetts" published by me five years since. In the present paper seven species†

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* In respect to the proof whereon this proposition rests, see my remarks on this point in the Memoirs of the Boston Society of Natural History, Vol. i, Pt. iv, p. 488 (foot note).

† Strix pratincola, Surnia ulula, Turdus nævius, Seiurus Ludovicianus, Centronyx Bairdii, Micropalama himantopus, Pelecanus erythrorhynchus.

are added to the list then given, four of which are entirely new to the fauna of the State, and the others have not before been fully established as occurring within it, though supposed to from their known general distribution. Two, the Barn Owl (*Strix pratincola*) and Varied Thrush (*Turdus nævius*), have only been previously given in Dr. Coues' Addenda to his "List of the Birds of New England."*

The latter occurs only as a straggler from the far interior and western portions of the continent. Another now added, the Baird's Finch (*Centronyx Bairdii*), discovered by Mr. C. J. Maynard at Ipswich (see notes beyond for farther particulars), is another similar example equally remarkable, it having been previously known only from near the mouth of the Yellowstone River. A few errors in that Catalogue are also now corrected, with the design of making that and the present paper a fair exposition of the ornithological fauna of the State, so far as it is at present known. Three species† there included are now stricken out. Numerous unrecorded instances of the capture of rare specimens within the State are also chronicled, as also the breeding of a few not before positively known to breed here. There are remarks also on a few species, for obvious reasons, that are not to be regarded as among the rarer species of the State.

The whole number of species of birds now known to occur in Massachusetts is three hundred.

GERFALCON. *Falco sacer* Forster. (*F. candicans et Islandicus* Auct.) A specimen in the speckled plumage was taken near Providence, R. I., by Mr. Newton Dexter, during the winter of 1864 and 1865. Its occurrence so far south appears to be wholly accidental.

The suspicion many authors have had that the *F. candicans* and *F. Islandicus* were but birds of the same species in different states of plumage, my own examination of speci-

* Proceedings of the Essex Institute, Vol. v, p. 312.

† Archibuteo Sancti-Johannis, Helminthophaga Swainsonii, Quiscalus major.

mens of both, in the Museum of the Boston Society of Natural History and elsewhere, has led me to believe is actually the fact. Sabine, so long ago as 1819, I think has fully shown this in his remarks on *Falco Islandicus* in his Memoir on the Birds of Greenland.* According to the late lamented Mr. Cassin, *sacer* is the specific name which has priority for this species.†

DUCK HAWK. *Falco peregrinus* Linn. (*Falco anatum* Bon., and *F. nigriceps* Cass). I stated in my Catalogue, published five years since, that the eggs and the young of this species had been taken at different times from Mount Tom, and that the young had also been obtained from Talcott Mountain in Connecticut. A few months later I had the pleasure of giving a full account of the eyrie on Mount Tom, with a detailed description of the eggs, and some general remarks on the distribution of this interesting species in the breeding season.‡ These eggs were the first eggs of the Duck Hawk known to naturalists to have been obtained in the United States, the previous most southern locality whence they had been taken being Labrador; but the species had previously been observed in the breeding season by Dr. S. S. Haldeman as far south as Harper's Ferry, Virginia. One or more pairs of these birds have been seen about Mounts Tom and Holyoke every season since the first discovery of the eggs at the former locality in 1864. Mr. C. W. Bennett, of Holyoke, their discoverer, has since carefully watched them, and his frequent laborious searches for their nest have been well rewarded. In 1866 he took a second set of eggs, three in number, from the eyrie previously occupied. In 1867 the male bird was killed late in April, and this apparently prevented their breeding there that year, as they probably otherwise would have done. At least no nest was that

*Transact. London Linn. Soc., Vol. xx, p. 528.

†See Dr. Coues' List of the Birds of New England, Proceedings of the Essex Institute, Vol. v, p. 254.

‡See Proceedings Essex Institute, Vol. iv, p. 153.

year discovered. In 1868 hawks of this species were seen about the mountains, and although they reared their young there, all effort to discover their nest was ineffectual. The present year (1869) they commenced to lay in the old nesting place, but as they were robbed when but one egg had been deposited, they deserted it and chose a site still more inaccessible. Here they were equally unfortunate, for during a visit to this mountain, in company with Mr. Bennett (April 28th), we had the great pleasure of discovering their second eyrie, and from which, with considerable difficulty, three freshly laid eggs were obtained. Not discouraged by this second misfortune, they nested again, this time depositing their eggs in the old eyrie from which all except the last set of eggs have been obtained. Again they were unfortunate, Mr. Bennett removing their second set of eggs, three in number, May 23d, at which time incubation had just commenced. The birds remained about the mountain all the summer, and from the anxiety they manifested in August it appears not improbable that they laid a third time, and at this late period had unfledged young.

The first set of eggs and the female parent, collected April 19th, 1864, are in the Museum of Natural History at Springfield, as also a male killed subsequently at the same locality in April; the second set, collected in April, 1866, are in the cabinet of Mr. E. A. Samuels; the third and fourth sets, collected April 28th and May 23d, 1869, are in that of Dr. William Wood, of East Windsor Hill, Conn. Although in each set the different eggs sometimes varied considerably from each other, neither of the three last present that remarkable range of variation exhibited by the first.* It is probable that some years more than one pair have nested on Mount Tom, but only one nest-site had been discovered before the present year. I learn from Dr. Wood that this bird is every year seen also about Talcott Mountain, and that it probably regularly breeds there. The young

* See Proceedings of the Essex Institute, Vol. iv, p. 157.

obtained from it in 1862 Dr. Wood kept till the following fall, when they were sent to Professor Baird, and died at the Smithsonian Institution the succeeding spring. Mr. G. A. Boardman informs me that the Duck Hawk in summer keeps about the islands in the Bay of Fundy, and "breeds upon the high cliffs all along this bay.*"

As stated by me elsewhere,† the Duck Hawks repair to Mount Tom very early in the spring, and for a month or six weeks, as Mr. Bennett informs me, carefully watch and defend their eyrie. They often manifest even more alarm at this early period when it is approached than they do later when it contains eggs or young.

SPARROW HAWK. *Falco sparverius* Linn. In reference to this species, Dr. Wood communicates the following interesting fact. "A few years since a pair of Sparrow Hawks attacked and killed a pair of doves and took possession of the dove cot and laid four eggs. Being too familiar with the farmer's chickens they were shot, and I had the good fortune to obtain two of the eggs."

GOSHAWK. *Astur atricapillus* Bon. This species varies most remarkably in the number of its representatives seen in different years, and also in the same season at localities in Southern New England not far apart. Some winters—the only season at which it is usually seen in Massachusetts—it is extremely rare, while the next it may be one of the most numerous species of its family. In years when it is generally common some of our most careful observers do not meet with it. Dr. Wood writes me, under date of October 22d, 1868, that with him "it has been a very rare winter visitor until the last winter, when they were more common than any of our rapacious birds. I mounted five specimens and sent away several for exchanges. I think twenty were shot within a radius of five miles. I have resided at East Windsor Hill twenty-one years, and have

* In epist., Sept. 19, 1864.

† Proceedings of the Essex Institute, Vol. iv. p. 155.

known only three specimens taken here prior to 1867." At Springfield, less than twenty miles in a direct line north of East Windsor Hill, and at nearly the same elevation above the sea, I have known them to be quite common during several winters within the last ten years. Mr. J. G. Scott says it was common at Westfield in 1867, and not rare during the three or four winters immediately preceding. When numerous this species is very destructive to the Ruffed Grouse, which forms its principal food. In some localities they sometimes hunt them almost to extermination.

Mr. C. J. Maynard informs me that he is confident that this species sometimes breeds in Massachusetts. He says he once observed a pair at a locality in Weston until the latter part of May; after this time he had no opportunity of observing them, but he feels sure that they bred there. This is not improbable, since its usual breeding range embraces the greater part of northern New England, and probably the mountains of Western Massachusetts.

Dr. Wood mentions in his letters another interesting fact respecting this bird, which I think all careful observers are apt to notice, not only in this species but as a general fact; namely, that the birds in immature plumage are often larger than any specimens obtained in mature plumage. Dr. Wood observes, "the young are very unlike the adult both in size and markings; the young is the largest until after moulting, when the wing and tail feathers never again acquire their former dimensions. The same difference is observable in the Bald Eagle between the young and the adult."* I have myself observed it in *Ardea herodias* and other Herons, in Thrushes, and in *Larus argentatus*, and other species of *Laridæ*. This difference in size between the adult and the young has also been reported to me by Messrs. Maynard and Bennett.

RED-SHOULDERED HAWK. *Buteo lineatus* Jard. This species was placed in the list of "Summer Visitants" instead of

* See also American Naturalist, October, 1869.

among the "Resident Species," as it should have been, in my Catalogue. At Springfield, I have rarely observed it in winter; but I learn from Dr. Brewer, Mr. Maynard and others, that it is in some sections of the state a quite common species at that season.

CALIFORNIA HAWK. *Buteo Cooperii* Cassin. A specimen of this species was shot in Fresh Pond woods, Cambridge, November 17, 1866, by Mr. William Brewster, of Cambridge, in whose collection it was detected a few months since by Mr. Maynard. It seems to be the first specimen yet reported from east of the Rocky Mountains. It is one of the most characteristic of the *Buteones* of this continent, and there seems to be not the slightest reason to question its capture in Cambridge.

ROUGH-LEGGED HAWK. BLACK HAWK. *Archibuteo lagopus* Gray. (*A. lagopus et Sancti-Johannis* Auct.) Generally not uncommon in winter in the Connecticut Valley.

Dr. Wood is of the opinion that the Rough-legged Hawk and the Black Hawk are the same. "I have," he says, "all shades of color from the light to the black, and I am unable to find the dividing line; both have the same measurements, the same claws and bill, the same habits, come and leave at the same time, and hunt together. I have them almost black with the faint markings of the lighter bird, showing to my mind that the lighter markings become extinct as the black increases, or as the bird increases in age. Those who claim that they are distinct say that in some localities the Rough-legs are common and no Black Hawks are to be seen. This proves nothing. The young of the Red-throated Diver are very common in Long Island Sound, yet the adult is never seen there. So it is with the Crested Grebe; the young are found here in winter — never the adult." *

On another occasion, when writing on this point, Dr. Wood expressed his views still more strongly, as follows: "The Rough-legged Falcon and Black Hawk *are the same*. I have

* In epist. Oct. 22, 1868.

taken and examined, I presume, forty specimens. *They are the same bird*, but not of the same age. The black is the adult. . . . . The differences in markings between them are not as great as in many birds, as, for example, in the Bald Eagle, the Golden Eye, Sheldrake, etc. I have taken them from those with the lightest markings to jet black, with all the intermediate varieties in color. So gradually do they become more and more black till jet black is reached, that I will defy any one to draw the separating line. It would be as difficult as to tell when the 'pig becomes a hog.'"*

The late Mr. Lucius Clarke, of Northampton, I have been informed, had a similar series, and that from an examination of a large number of specimens he had arrived at the same conclusion. I have not yet had an opportunity of comparing a very large number, but from a study of those I have seen, and of the accounts given by authors, I believe the view taken by Dr. Wood and Mr. Clark to be the correct one.

TROUT FISHING IN THE YOSEMITE VALLEY.

BY HON. J. D. CATON.

By far the hardest day's work the tourist has in "doing" the wonderful valley is the visit to the Vernal and the Nevada falls, where the Merced River makes a clear leap of three hundred feet over the first, and seven hundred feet over the second. Our guide, Mr. Cunningham, assured me that not a fish of any kind is found in the river, or any of its tributaries above the first or lower fall. Below these falls several varieties occur, the most interesting and the most abundant of which is the Speckled Trout (*Salmo iridea* Gib.). It differs materially from its cousin, the Speckled Trout of the Eastern States (*Salmo fontinalis*), especially in habit and

*In epist. Sept. 5, 1864.

coloring, and is more sluggish in movement and less voracious in appetite. Its spots are all black, less regular in size, form and arrangement, and it has a coppery stripe running along the lower part of either side. It was the unanimous verdict of our party that its flesh is inferior to that of the eastern brook trout, though it was highly relished by all. The waters of the river are almost as transparent as the atmosphere, and are as cold as it is safe to bathe in. The trout were so abundant that usually several were in view to the observer standing on the river bank, but so shy that one would rarely remain within forty feet.* The Indians daily brought in large strings taken with the hook, which they sold to Mr. Hutchings, our landlord; but it was said, that with one exception, no white man had ever taken one. The bait always used by the natives is the angle-worm, which Mr. Hutchings assured me was found abundant in the valley by the first white visitors. I may pause here to say that this statement interested me much from the fact that none of these worms were ever found on Lake Superior till they were planted there; ten years ago those who used them for bait were obliged to take them along. I planted the first at Eagle River, seven years since, with worms taken from Ottawa, Illinois, and they have flourished finely since.

After nine hours of travel on a very hot day, we returned from viewing the falls to the hotel. While the rest of the party sought rest on beds in their rooms, or on robes or blankets under the oaks, I determined to try my hand with the trout. I overhauled my satchel and found a few flies and some naked hooks, and a very indifferent line. Mine host loaned me a Chinese rod, which answered well enough. I first essayed with artificial flies, from behind a bunch of willows, by which I was entirely concealed. They simply laughed at all my efforts at deception. They seemed as indifferent to any fly which I had as they would

*They were generally observed moving slowly about from six to twelve inches below the surface. The current is very strong.

be to a willow leaf. I stopped fishing, and observed them for nearly an hour from my concealment. They were constantly rising to the surface for something floating on the water, though not with the dash and *vim* of an eastern trout, but with a staid and dignified pace which seemed to say they were quite indifferent whether they caught their victims or not. It was clear then that with a proper fly and the laziest possible mode of handling it would persuade them. I now resorted to the angle-worms.* I fished in deep water and in shallow, in the rapids and in the eddies, with every mode and motion I had ever found successful with trout. It was of no use. Sometimes one would approach in a sluggish way and smell of the bait, but would never touch it. I then tried them as if fishing for black bass, but with no better success,† and in that deep gorge hemmed in by vertical walls four thousand feet high, it already seemed as if night was upon me. Still as the Indians often take them in the night with the same bait, I thought I would try another mode. I went at them now as if I were fishing for black pike in the Illinois or Fox River. I threw the bait into the swift current well above me and allowed it to float till it grounded as far down the stream as the line would allow. Here it was allowed to remain for perhaps five seconds, and then with a moderate but steady motion it was brought up stream and towards the surface. The secret was solved. It had not been raised from the bottom more than a foot, when it was met by a trout about twelve inches long, but I did not make sufficient allowance for his sluggish habits, and struck before he had well taken the hook, and he fell back into the water close by the bank. Several succeeding casts were unsuccessful. Soon, however, a stranger came along, and was deceived by my unprofessional practices, and took the bait as it was rising from the bottom in a way that seemed

* With which a juvenile "Lo." had supplied me for a dime.

† The last rays of the setting sun had ceased to play on the smooth face of South Dome which towered above me almost a mile in altitude.

to say, "I don't much care whether you escape me or not." I however gave him plenty of time and then landed him. If I had been too quick with the first, I was too slow with this, for the hook had quite disappeared, so that a knife was necessary to disengage it, and my prize was so much disfigured as to spoil it for a specimen. It was now nearly dark, and without another cast I hastened home, where I found my party busily engaged discussing a comfortable dinner. Senator H. suspended his gastronŏmic occupation and carefully examined my prize, and then deliberately surveyed the captor, and at last profoundly remarked, "this should be considered no exception to the rule of this valley that the trout will not bite a white man's hook. The fish should be pardoned, for the mistake was most natural." And then the whole party, with a spirit only known in a jovial excursion party determined to make the most of every incident, struck up "so say we all of us." I forgave the ladies at least, for nearly all had excellent voices and were always ready to use them on the least provocation; but I yet owe the senator *one.*

THE ESQUIMAUX DOG.

BY H. M. BANNISTER.

The study of the domestic animals of a barbarous nation or tribe is chiefly interesting as throwing some additional light upon their physical and intellectual status, and is therefore a fit adjunct to the study of their ethnological and historical relations. When, however, the species are, as it were, unique in this capacity, or when through domestication any very remarkable variation from the usual type appears to have been produced, they then become of more general interest. Under this latter class we may placo the

Esquimaux Dog; and, although it may require more of faith in the Darwinian hypothesis than every one feels obliged to possess, to acknowledge it as a distinct species from the "curs of low degree" which infest our civilization, no one will fail to concede that it is a sufficiently well marked variety. Being thus remarkable, it has received more or less notice from nearly every voyager on the more northern coasts of our continent; and notwithstanding that the subject is therefore not entirely new, I venture to add a few observations of my own, made during a residence of about a year on the coasts of Alaska, near Behring's Straits.

There is no necessity of going into detail as to the general appearance of our subject, in this place, as descriptions are sufficiently numerous and accessible in works of travel, cyclopedias, etc., the habits and peculiarities in other respects, affording sufficient grounds for remarks. Suffice it merely to say, that with his heavy, but even coat of hair filling up and rounding off the hollows and angles of his body, his bushy tail curling over his back, erect ears, and the generally intelligent expression of countenance, the Esquimaux Dog may be called a rather handsome animal. The average size appears to me to have been overestimated in some of the descriptions, although the breed may attain larger dimensions in other regions than that in which I observed it. A few individuals were seen which approached or equalled in size the Newfoundland dog, but by far the greater number were decidedly smaller, some appearing even diminutive in comparison; still, however, preserving all the characteristic marks of the variety. In color they vary from white to black through the different shades of gray and brown, a very large proportion being piebald. Some of these variations in size and color may perhaps be owing to a slight admixture of foreign blood, as there are among the Alaska Esquimaux a large number of mongrels, with the Indian dogs of the interior, the Siberian dogs introduced by the Russians, and doubtless with various forms of the dogs

of civilization, even down to the familiar "yellow dog," of which variety one or two quite typical specimens were seen during my stay in the country; in these instances, most probably introduced by whalers. The Siberian dogs themselves, as seen in Kamtchatka are not always very different from the Esquimaux type, and the dogs of the sedentary Tchuktchi, or Asiatic Esquimaux, are, if not the same as those of the American coast, a very nearly allied variety. From the regular traffic which has been carried on from time immemorial across the straits, we may infer that a very considerable mixture has been made between the dogs of the two continents. The natives frequently take their dogs with them in their summer trips by water; and a full loaded oomiak under sail, with its lading rising a foot or so above the gunwale amidships, and kept from falling overboard by sticks stuck up on each side, one or two kayaks carried athwartships over all, or towing astern, and with its full complement of male Innuits, squaws, papooses and dogs, is rather astonishing to one's preconceived ideas of Esquimaux navigation.

The external coating of long hair is underlaid in the Esquimaux dog by a denser mat of closely interwoven fibres, which, though coarse, seem to have sufficient length and toughness to allow of its being spun out into thread. I have seen, indeed, a blanket, brought from the Mackenzie's River District of the Hudson Bay Territory, which was said to have been woven from dog's hair, probably of this, or a closely related variety, the Hare Indian dog. In the summer time this wool may be easily pulled off in large patches provided the animal is kind enough to allow the handling, which is not invariably the case. This, with the dense covering of shorter hairs on their legs and feet, appears to make them indifferent to almost any degree of cold, as they frequently and habitually pass the bitterest nights and fiercest storms of the arctic winter, with no other shelter than is afforded by the lee side of a native hut, and sometimes without even that. Nor do other apparent sources of dis-

comfort appear to trouble them much. I remember seeing at St. Michael's, during one of the coldest days of December, one of the Fort dogs comfortably asleep on the steps leading to the door of a store-house, with his hinder quarters at the top, and his head near the bottom, his whole body some twenty or thirty degrees out of the horizontal. Another advantage of their heavy outer covering, and not an inconsiderable one, is that it enables them the better to undergo the disciplinary ordeal of the whip, enough in some intances, it would seem, to make raw hide thongs of an ordinary dog skin.

The Esquimaux dog does not bark, and this, together with the short quick snap of his bite, is the most wolfish trait which he retains from his supposed ancestry. There is, however, no lack of voice, or the exercise of it; he howls most dismally whenever the spirit moves him. Those who have had experiences of wolves and coyotes on the plains, can form but a faint idea of what it is to have two or three dozen Esquimaux dogs howling in concert within a few feet of one's head. The noise will go through two or three log partitions, and then be altogether trying to human nerves. There are times, nevertheless, when it is rather comical than otherwise; as, for instance, when they exert themselves in this direction in starting on a journey. As soon as the sled is brought out, and while the load is being adjusted upon it, the dogs gather around, and, fairly dancing with excitement, raise their voices in about a dozen unmelodious strains. There are often one or two who have to be dragged up to their duty by a whip-lash around their necks, and they add their peculiarly lugubrious, half strangled notes to the general discord. This kind of row is renewed every time they start, until travel and hard work have taken the spirit out of them, when they go to their work in a dogged, business-like manner without any particular uproar.

From five to seven dogs are generally used together in a team, though the poorer natives often make shift to get along

with a less number, a single dog being sometimes made to do duty alone. On the other hand the Russian traders, and more rarely the Esquimaux, occasionally put eight and nine dogs in a single team. The pups, as soon as they are able to travel, are fastened up with the older dogs, and learn their business very rapidly. Once in a while one breaks down on a journey, and is then often inhumanly abandoned where he drops; but they generally get along marvellously well, allowing for their tender age.

The Alaskan Esquimaux sled is a rather heavy looking affair, nine or ten feet in length by about two in breadth, with thick, strong runners, often shod with pieces of solid whalebone. To the front of this is attached a strong raw-hide thong or rope, eleven or twelve feet in length, to which the dogs are fastened by a simple harness, consisting in its most elaborate form, of a breast band and another strip passing over the back, and underneath the dog immediately behind his fore legs. The continuations of the breast band, passing backward on each side, join over the back, and from this junction is continued a short trace, by which the dog is fastened to the above mentioned rope, usually in equal numbers on each side, and one at the end. By this arrangement a great deal of the strength of the dog is wasted in side draft; notwithstanding this, it is probably the best that can be made, since it allows of no such irremediable snarling of the lines as would inevitably result were any more complicated arrangement adopted. A team of dogs will frequently stop when under full headway to engage in a general fight; and on being brought to order by an energetic use of the whip, both lash and stock, will jump to their places and proceed as before, without any confusion or entanglement whatever.

The amount of load carried on these sleds varies of course with the number and condition of the animals, but perhaps seventy-five pounds to a dog is a little above, rather than below the average. The greatest feat of this sort which came

under my observation was performed by one of the fort teams of eight dogs, all, with perhaps one exception, of pure Esquimaux breed, but the finest of their class, several of them fully equalling in size a Newfoundlander. They travelled about forty miles in a single day, part of the distance through freshly fallen and drifted snow, drawing, on one of the before mentioned heavy native sleds, nearly eight hundred pounds of reindeer meat; the whole, with the sled, probably approaching a thousand pounds in weight. I never heard of any team of Esquimaux dogs excelling this, but was informed by the late Major Kennicott that the Hudson Bay Company traders with a peculiar breed of introduced dogs, somewhat resembling the Danish mastiff, load their light sleds with an average allowance of about one hundred pounds to each dog.

The art of guiding the team by the whip and voice appears to be almost unknown among the Alaskan Esquimaux; it is customary with them to keep a man running ahead of the sled to show the way, the dogs following him instinctively. When, however, the route has been often travelled over before by the same team, or when there is a previously made sled track for the dogs to follow, the runner is sometimes dispensed with. In the sled teams of the Russian traders, and not so invariably in those of the natives, the leading dog is always the same, and often becomes so habituated and attached to this position, that he will resent being put in any other place in the team. These leaders are generally selected for their willingness to work; pluck and sagacity also being considered. Strength and size, though valuable in this position, are of secondary importance; a small plucky dog will sometimes achieve and hold this preëminence by sheer moral force, and a first-class leader holds it in his ordinary intercourse with the other dogs as well as when fastened up with them in harness. Much is trusted to the sagacity of a good leader, in the way of picking out the route, avoiding obstacles, etc. In fol-

lowing a previously made sled track he does not always follow it blindly, but will frequently cut across short turns and show a considerable exercise of judgment in other ways. In the winter of 1865–'66, a small party of Russian traders and Esquimaux employees, some half a dozen persons altogether, while travelling with dogs and sleds, between the mouth of the Yukon River and Fort St. Michael's, on Norton Sound, were caught in a very severe snow-storm near the southern point of St. Michael's Island, a flat marshy region, very much intersected by water channels winding in every direction. The driving snow completely obscured all the landmarks, and the early nightfall of these latitudes coming on about the same time, they became confused and lost their way entirely. Having in the party no compass or other means of directing their course, their only recourse was to call in the runner and trust to the intelligence of one of the leaders, an old dog which had been tried in similar emergencies and had not been found wanting, to bring them out of their peril. The plan succeeded; and under his guidance they arrived safely at their destination, a result which they all admitted could hardly have happened had they been left to their own direction. I give this story on the authority of the members of the party; the dog in question was unanimously praised for his knowingness. I can myself testify to his general sagacity. If his finding the way must be accounted for, I should attribute it to his previous knowledge of the country, rather than to instinct or power of scent, which does not appear to be very remarkably developed in this variety.

Most travellers have mentioned the voracity of these dogs in times of general scarcity. There appears then to be n limit to their appetite; nothing is safe from them; they wi devour old boots, rawhide ropes, and have even been know to tear up and swallow cotton cloth and old rags. T dogs belonging to the natives undergo such periods of st vation pretty regularly, and many succumb nearly ev

winter to the combined effects of want of food and hard work. There is also an epidemic disease which is very destructive some years, and is undoubtedly the same as that described by Dr. Hayes as occurring amongst his dogs on Smith's Sound during the winter of 1860–'61. As in the cases related by him, the symptoms closely resembled those of hydrophobia, but the disease does not appear to be so communicable by the bite. There seems also to be some connection between the disease and the nature and quantity of the food, as it was mostly confined in its ravages during the winter of 1865–'66 to the poorly and irregularly fed dogs of the natives, while the better cared for animals of the Russian traders suffered in a much less proportion. Genuine hydrophobia does sometimes occur; a most unmistakable case of it was observed during the summer of 1866.

During the summer months, from May to September, the dogs are fed only irregularly by most of their owners, and are sometimes left entirely to themselves to find their own living. In spite of this they usually manage to grow fat during this season, and to make up all they have lost in strength and substance during the winter. They supply themselves with fresh game, not only the smaller quadrupeds and grouse, but also occasionally running down a deer. Their hunting instincts are so strongly developed, that while travelling in the winter, if a reindeer or even a fox or rabbit is in sight, it is quite difficult to keep any control over the dogs, and the mere utterance of the word *tung tuk* (Esquimaux for reindeer) is often effectual to enliven a lagging team. Many dogs wander off after deer in the summer and are lost to their owners; and as comparatively few stray dogs are picked up, it appears that the greater number of these either revert to the wild state, or are destroyed by wolves and other beasts of prey. Wolves sometimes attack and carry off dogs from trading posts and villages. In the spring of 1866, a wolf attacked some twenty or thirty dogs just outside of the stockade at St. Michael's. The uproar

brought the whole force of workmen to the rescue, otherwise he would certainly have made way with one or more; for Esquimaux dogs in almost any number, are no match for a northern wolf.

Of the other breeds of dogs which are used as draught animals in the north, I have already mentioned the large dogs of the Hudson Bay Company's traders, which are known to me only by description. The Indian dogs appear, for the most part, like a very degraded variety derived from the wolf. A peculiar variety, of unknown origin, but probably from Europe or Siberia, was used to some extent by the Russians. In appearance it resembles the shepherd dog, but stands as high as a Newfoundlander. Its shape is slenderer than that of the native breed, and the hair is shorter, the colors are usually black or dark brown and white or tan, with a yellow spot over each eye, as in some of the terriers. They appear to be quite as hardy and serviceable as the native variety. I have known a team composed chiefly of dogs of this breed to travel with a light load over a well marked track, between sixty and seventy miles in a single day.

OUR COMMON FRESH-WATER SHELLS.

BY E. S. MORSE.

In this and a few succeeding papers we intend to give a brief outline of several groups of fresh-water mollusks common to the United States.

The intention is to make them useful to the young collector in enabling him to determine the generic names of the more common shells he may have in his collections, and to give him some idea of their habits and structure. He will also become acquainted with the specific names of the more common shells he meets with. Nothing more than a brief

Fig. 3.

Fig. 2.

Fig. 1.

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 4.

Fig. 9.

Fig. 10.

Fig. 8.

Fig. 11.

Fig. 12.

Fig. 13.

Fig. 14.

Fig. 15.

Fig. 16.

Fig. 18.

Fig. 17.

Fig. 20.

Fig. 22.

Fig. 21.

Fig. 19.

MORSE, ON OUR COMMON FRESH-WATER SHELLS.

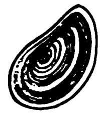
sketch will be attempted. In one sense the papers will be a compilation from the treatises of Prime, Binney, Bland, and others, published by the Smithsonian Institution, through whose liberality we are enabled to illustrate this and the papers which are to follow.

A shell common in most of the streams and ponds of New England, a figure of which is here given, Fig. 78, belongs to a group of mollusks that is distributed throughout the northern hemisphere. They are usually found in muddy streams or ponds, either grovelling an inch or so in the mud or among roots, or crawling along over the sand.

Fig. 78.

The creeping disk is quite long and broad. The little snout, on each side of which may be seen the tentacles, with eyes at their bases, projects beyond the margin of the shell in front, while behind the shell, and attached to the upper part of the tail may be seen a semi-circular corneous plate called the operculum, Fig. 79. In Pl. 9, fig. 2, another species is represented in the attitude of crawling, showing the position of the operculum. When the animal retires within its shell the head and forward part of the foot disappears first, followed by the tail with the operculum, which answers as a lid, or door to close the aperture of the shell. In Figs. 1 and 3 of the plate, the appearance of the operculum is shown within the aperture of the shell. As the shell increases in size, by the addition of tiny particles around the margin of the aperture, the operculum increases likewise by the addition of the corneous substance around its margin, and the little concentric furrows seen in the figure of the operculum indicate its successive rates of increase. Most marine Gasteropods (the name of the class to which all those mollusks belong that have a broad creeping disk) are furnished

Fig. 79.



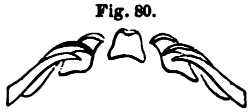
with opercula, though they vary greatly in composition and shape. Some are strengthened by the addition of lime, and are quite solid; of this kind is the eye tone, so called; some are claw-shaped, circular, or very irregular in form. In most species the operculum fits the aperture of the shell very closely; in others the operculum is rudimentary. In *Strombus*, or the conch-shell, it is long and sharp, projecting some way beyond that portion of the foot to which it is attached, and the animal uses it by thrusting it into the sand, and then by a quick muscular contraction throwing its whole body forward. While most mollusks lay eggs, some in a glairy mass, as in the air-breathing water snails, or in a series of pods like the whelk, the group of which we are now treating, bring forth the young alive, but the young are simply hatched from the egg, before the egg leaves the parent; hence they are called ovoviviparous. On breaking open the shell of a female in spring time, the young ones may be found of various sizes within their globular eggs.

The species figured above, and also in Pl. 9, fig. 11, is now known as *Melantho decisa*, and is the only species found in New England. The shell is quite solid, having four or five whorls; though the first two whorls, forming the tip of the shell, is always absent from erosion. In young specimens a perfect one may be found; but adult shells are always imperfect, as shown in the figure. The color of the shell varies in being a light or dark green, and shiny. Within the aperture the shell is bluish white.

Those who have the first volume of this magazine will recall the description there given of the tongue of a land snail, in which it was stated that the floor of the snail's mouth was lined by a membrane covered with many rows of minute spurs, or teeth, and that the snail used this tongue in rasping its food. Now these minute teeth furnish admirable characters in the classification of these minor groups of mollusks. Thus the air breathing snails which have no operculum have the tongue lined with rows of very nu-

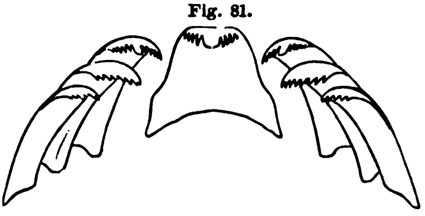
merous teeth; while those air breathing snails which have an operculum usually have a long slender tongue and have only seven teeth in a row, and in this feature they resemble the group now under consideration. Fig. 80 represents one row of teeth taken from *Melantho decisa*. This species contains about forty rows of teeth, and as these teeth always hook backward they act admirably as a rasp in licking up their food. The members of this family found in the United States represent four well marked genera containing about twenty species. The two principal ones are *Vivipara* and *Melantho*.

Fig. 80.



In Vivipara the shell is generally thinner, more globose, the lingual teeth are always strongly notched; see Fig. 81. (Compare this with the teeth of *Melantho decisa*, Fig. 80). The disk of the animal does not project beyond the snout. See Plate 9, fig. 2. It will be noticed that there are two distinct folds, one on each side of the aperture of the shell, and these form regular conduits for the water to enter and bathe the gills for respiration; the water entering by the right opening, and finding egress by the left one. (See Plate 9, fig. 4). In Melantho the shell is not so globose, but is more solid, and the lingual teeth are smooth, or only slightly serrated.

Fig. 81.



The foot also projects far beyond the snout, as in the figure of *Melantho decisa*, and the folds which conduct the water to the gills do not form regular tubular conduits as in Vivipara. We will now mention briefly the more prominent species, figures of which will be found in the plate.

Vivipara intertexta Say, Plate 9, figs. 2, 3, 4, has a very globose shell, yellowish green or brownish horn color, having numerous nearly obsolete revolving lines. The species has been found in Louisiana, South Carolina and Iowa. *Vi-*

vipara subpurpura Say, Plate 9, fig. 8, has an oblong, subovate shell, olivaceous in color, with a tinge of purple. Figs. 9 and 10 represent younger specimens. Mr. Binney says he has traced this species from Texas through Louisiana and Mississippi to Key West, Fla., and in the Western States of Indiana, Wisconsin, and Missouri.

V. contectoides W. G. Binney, Pl. 9, figs. 5, adult; 6 and 7, young. The shell of this species is ornamented with four revolving bands, is quite smooth and shiny, and the umbilicus is open. The shell closely resembles a common European species. Found in nearly all the Southern and Western States.

Vivipara Georgiana Lea, Plate 9, figs. 1 and 15, operculum. This species inhabits Florida, Georgia, South Carolina and Alabama. There are other species of this genus in the United States, but it was our intention to mention only those that were more characteristic.

Fig. 82.

Of *Melantho* we have several well marked species, among which *Melantho ponderosa* Say (Plate 9, figs. 14 and 16, young; figs. 19 and 20, adult), is the largest. It is a heavy solid shell an inch and a half in length, greenish horn color. It has been found in Ohio, Indiana, Illinois, Michigan, Tennessee and Alabama. Fig. 82 shows the shell with the animal extended. The creeping disk is bent upon itself. The operculum may be seen on the hinder portion of the body, and the tentacles and eyes are seen near the aperture of the shell.

Melantho decisa Say, Plate 9, fig. 11, represents the species common to the New England States. Some specimens are very smooth and bright green in color. They are all devoid of an apex, and this is a characteristic feature. Sometimes the shell is found reversed; that is, the spire twists the other way.

Melantho integra Say, Plate 9, figs. 17, 18, 21 and 22. This shell is abundant in the Western States. Mr. Binney is inclined, from an examination of a large number of specimens, to believe that it is the same species as the one just mentioned, and he may be right, but the weight of authority is against him. The differences between the male shell, Fig. 22, and the female shell, Fig. 21, are quite marked.

Melantho coarctata Lea, Plate 9, figs. 12 and 13, occurs in South Carolina, Alabama, Mississippi and Arkansas. There are other species of this genus in the United States, but it was our intention to enumerate only the more prominent species of each genus presented. It would be of the highest interest for the collector to diligently seek for specimens of this group from all localities, and compare them to see where the lines may be drawn between the species. We suggest this, since there is so much variance of opinion between writers on this subject. Mr. Binney to whom we are much indebted for the work which has been so generously published by the Smithsonian Institution, has brought together a vast amount of material, and while he may have been too conservative, we prefer this, to the lamentable practice of many, in describing from a single specimen. In the specimens mentioned above we have relied on the accuracy of the figures in identifying the species, and for this reason the descriptions are either brief or wholly wanting.

THE VIRGINIA PARTRIDGE.

BY AUGUSTUS FOWLER.

The *Ortyx Virginianus* is a resident bird, and was more common in former years than at the present time. Thirty years ago a covey of from five to thirty of them could be flushed on almost any farm in Essex County. Now one of

them is seldom met with. It is not in the clearing away of our forest and the cultivation of the land, nor the increase of population, that makes the decline in their numbers, for they are birds whose habits do not lead them to the retirement of the deep forest, but rather to the cultivated fields, to small patches of woodland, and to bushy pastures; in fact, in winter they not unfrequently visit the hay and corn rick and barnyard of the farmer, and are sometimes so familiar as to come from the fields and feed with his poultry. The great inducement which leads to the destruction of the Partridge is the delicious flavor of its flesh; and the most common modes used to take them, are traps that secure a whole covey at one time. Many of them are taken by means of the gun; not so many fall by it, however, as are captured by the snare or trap; although a good gunner can secure a flock if he selects the right kind of a day, in the right season of the year. The best season to hunt the Partridge is in the winter, on a snowy day; and the faster it snows the more sure is he of success and of good sport. On such days the birds usually leave the more open lands and resort to sheltered situations, such as small pine woodlands, if any such are in their vicinity. The sportsman enters the woods. Not a sound is heard. The fall of his footsteps are as silent as the fall of the snow around him; no rustling of leaves, or the crackling of dried sticks beneath his feet is heard to disturb the stillness. He walks silently on, with his mind prepared for a surprise shot; as yet the silence prevails, when, sudden as thought, up rise before him a covey of Partridges on loud whirring wings, and fly in different directions; he selects the one which flies directly before him and fires; by being prepared, and not excited by the sudden springing of the birds, he brings her down. Although they separate when flushed, they are gregarious and are fond of each other's company; and when they are thus separated, their well known call-note is sounded for a reunion.

The hunter stands in his tracks, and soon hears the notes

of one sounding loud and clear through the snowy air, and immediately directs his steps to the spot from where the sound came; after advancing a short distance, he stops and waits to hear the call-note again; soon it is heard louder than before; he now proceeds with certainty, and sees the bird perched on a rotten branch, beneath the snow-bent limb of a pine tree, and cautiously getting within range of him, he fires; having reloaded his gun he hears another bird in a different part of the woods; this one he may find on the ground near the roots of a tree, whose wide spreading branches and thick foliage bear many snows. He may proceed in like manner until he has secured them all. Such a day's sport, as a sportsman could have a few years ago, is now of rare occurrence; he may enter the coppice or small woodland and find the stillness there, but will not see the whirring game springing before him, nor hear their loud, shrill, clear whistle. I know that many flocks of the Partridge succumb to the rigors of our northern winters; roosting as they do on the ground, they seek some sheltered spot from the coming storm, such as the lea of a bunch of gray birches, barberry bushes, or ferns, and if the snow comes deep and heavy, or a crust forms upon its surface in the night, they are sure to die. They have not the energy and strength to extricate themselves from their situation, and in spring their remains, such as the feathers and bones of a whole covey, are found in such places. But the greatest cause for their decrease is capturing them in nets, when whole flocks of them are taken at a time; and, unless laws are enacted, and at once enforced, for their preservation, not only for the Partridge but for all the game birds throughout the country, we shall have cause to regret our delay in not suppressing the indiscriminate slaughter that is now carried on among them. The male Partridge has not the proud mien of the Ruffed Grouse, but his step is stately and his manners in the breeding season resemble those of the domestic cock. The female usually retires by herself, and is

seldom, though sometimes, accompanied by the male, and selects the spot for her nest, which is under a tuft of grass, or a bush, or something that affords both shelter and concealment, and makes it of dried grass or of such material as lies about the spot, and then lays from fifteen to twenty pure white eggs, which measure one and four-sixteenths of an inch in length, by fifteen-sixteenths of an inch in breadth; they are very pointed at the smaller end, and are put in such nice order within the nest that if taken out it is difficult to place them as they previously were. The young leave the nest soon after they are hatched, and follow their mother, who shows great anxiety for their welfare and will defend them when in danger at the cost of her life. When surprised with her brood she makes use of the same artifices with the Grouse and other birds which build upon the ground; at such times she will flutter along on the ground in the greatest disorder only a few feet in advance of a dog, and yet elude every attempt he may make to seize her, until she has led him a sufficient distance from her young ones, and then rising in the air by a circuitous route returns to them. I was once passing over a cart path that led between a woodland and a field from which barley had been lately harvested, and saw an old Partridge coming through the stubble with her numerous family towards the woods. I stopped to let them pass before me, and I soon saw by her movements that I was not discovered by her, and concealed myself as well as I could. As they approached the young ones were heard to call incessantly for their mother to stop and cover them. After she had cleared the stubble, she stood a moment upon one foot in the hard beaten track, and looked earnestly about, and apprehending no danger, she partly squatted down, and as the young emerged from the damp grass, with wet legs and thighs, they eagerly sought the warmth of her body by crowding under it, and although they were young and small, they jostled her considerably until they became settled. After brooding them for a time she led them into the woods.

Friendless bird! How is it possible for her to rear such a numerous family, when surrounded by so many enemies. Not only does man contrive many schemes to entrap them, but many of the rapacious quadrupeds and birds are ever ready to make them their prey. The mink follows them in the woods with as unerring skill as does the setter dog, while the red-tailed hawk hunts them in more open ground.

THE GREAT AUK.

BY PROFESSOR JAMES ORTON.

THE recent addition of a specimen of this rare bird to the Smithsonian Museum, is an event worthy of record. There are now three specimens in the United States; the one just mentioned, another in the Academy of Natural Sciences, Philadelphia, and a third in the Giraud Cabinet in Vassar College. The last is the most perfect specimen, and certainly possesses the greatest historical value, as it is the one from which Audubon made his drawing and description. It was caught on the banks of Newfoundland.

The Great Auk or Gare-fowl,* fortunately for itself did not live long enough to receive more than one scientific name—*Alca impennis*. It was about the size of a goose, with a large head, a curved, grooved and laterally flattened bill; wings rudimental, adapted to swimming only, approaching in this respect the penguins of the southern hemisphere. The toes are fully webbed, the hind one wanting; the plumage is black, excepting the under parts, the tips of the wings, and an oval spot in front of each eye, which are white. It was an arctic bird, dwelling chiefly in

*Buffon called it *Le Grand Pengouin*. Moehring adds the tribal name *Chenalopex* (fox goose) to distinguish it from the rest of the Alcidæ.

the Faroe Islands, Iceland, Greenland, and Newfoundland.* "Degraded as it were from the feathered rank (said Nuttall), and almost numbered with the amphibious monsters of the deep, the Auk seems condemned to dwell alone in those desolate and forsaken regions of the earth." But it was an unrivalled diver, and swam with great velocity. One chased by Mr. Bullock among the Northern Isles, left a six-oared boat far behind. It was undoubtedly a match for the Oxfords. It was finally shot, however, and is now in the British Museum. "It is observed by seamen," wrote Buffon a hundred years ago, "that it is never seen out of soundings, so that its appearance serves as an infallible direction to the land." It fed on fishes and marine plants, and laid either in the clefts of the rocks or in deep burrows a solitary egg, five inches long, with curious markings, resembling Chinese characters. The only noise it was known to utter was a gurgling sound. Once very abundant on both shores of the North Atlantic, it is now believed to be entirely extinct, none having been seen or heard of alive since 1844, when two were taken near Iceland.†

The death of a species is a more remarkable event than the end of an imperial dynasty. In the words of Darwin, "no fact in the long history of the world is so startling as the wide and repeated extermination of its inhabitants." What an epoch will that moment be when the last man shall give up the ghost! The upheaval or subsidence of strata, the encroachments of other animals, and climatal revolutions—which of these great causes of extinction now slowly l

* Audubon records the statement that formerly "Penguins were plentiful a Nahant and some other islands in the bay." But the old gunner, who gave hi information, must have meant the Razor-billed Auk.

[That the Great Auk was once very abundant on our New England shores, is proved be doubt by the large number of its bones that have been found in the ancient "Shellheaps tered along the coast from British America to Massachusetts. The "old hunter" w Audubon of its having been found at Nahant, was undoubtedly correct in his statement have bones of the species taken from the Shellheaps of Marblehead, Eagle Hill in Ipsw Plumb Island, and Mr. Elliot Cabot has informed me that an old fisherman living in described a bird to him, that was captured by his father in Ipswich many years ago, wh the description, Mr. Cabot was convinced was a specimen of the Great Auk.—F. W. P

† Owen makes this singular mistake: "The Great Auk existed in the last no specimen has been obtained in the present."

Fig. 83.

The GREAT AUK, *Alca impennis* Linnæus.
Copied from Audubon, Plate 465.

incessantly at work in the organic world, the Great Auk departed this life, we cannot say. We know of no changes on our northern coast sufficient to affect the conditions necessary to the existence of this oceanic bird. It has not been hunted down like the Dodo and Dinornis. The numerous bones on the shores of Greenland, Newfoundland, Iceland and Norway, attest its former abundance; but within the last century it has gradually become more and more scarce, and finally extinct. There is no better physical reason why some species perish than why man does not live forever. We can only say with Buffon, "it died out because time fought against it." From the *Lingula prima* to the Auk, genera have been constantly losing species, and species varieties; types and links are disappearing.

Still more mysterious than the extirpation of species, but equally interesting, is their coming into being. We must not expect this event to be conspicuous. We suppose that the ushering in of the puny sloth was as quietly and inappreciably done as the annihilation of its gigantic prototype, the Megatherium. We are rather compelled to believe in the continual formation of "incipient species" to take the place of those that have expired. But how? By transmutation or special creation? We will not decide; but we must hold to one or the other, or else believe there are far fewer species now than when man was added to the world's fauna. For how many animals which figure in Pleistocene strata are missing in the Recent Life! "That a renovating force, which has been in full operation for millions of years, should cease to act while the causes of extinction are still in full activity or even intensified by the occasion of man's destroying power, seems to me in the highest degree improbable."*

* Lyell's *Antiquity of Man*, p. 394.

REVIEWS.

Huxley's Classification of Animals.*—This is not a new work, but a republication, without revision, of the six lectures on the classification of animals, which form the first part of Professor Huxley's "Lectures on the Elements of Comparative Anatomy," published in 1864. It is perhaps the most compact, clearly written and modern text book of zoölogy, from the side of comparative anatomy, that is in the market, and we recommend it for study to be consulted with Agassiz and Gould's Principles of Zoölogy, and Milne-Edwards' Zoölogy. A large number of the admirable wood-cuts are original, the book is beautifully printed, and to us the perusal of the work has been a great treat. The author's style is clear and terse, and the writer, withal, so frank and outspoken, that we feel strongly the personality of his clear headed, sturdy intellect, though less far reaching and penetrative often, than clear sighted and decisive.

The author first gives the characters of the twenty-seven classes of animals recognized by him, which occupies one-half of the book. In a succeeding chapter he discusses their arrangement into larger groups, namely, the subkingdoms [branches, or types]. The branch of Vertebrates is retained as Cuvier left it. As regards the branch of Articulates, the author is disposed to break it up into two branches, *i.e.*, the Annulosa (Insecta, Myriapoda, Arachnida, Crustacea, and the Annelida); and the Annuloida (Echinodermata and Scolecida). Cuvier's branch of Mollusca is subdivided into the Mollusca and Molluscoida (Ascidians, Brachiopods and Polyzoa). The branch of Radiata is subdivided into the Echinodermata and Cœlenterata (Acalephs and Polyps), while the Protozoa, the fifth subkingdom, added since Cuvier's time, are subdivided into Infusoria and Protozoa. Thus out of the wilderness of classes into which we plunge at the beginning of the work, he finally presents us with a hasty view of eight branches, or subkingdoms, of the animal kingdom. All the lower subkingdoms he considers as the equivalents, or nearly so, of the Vertebrates for instance, though he expresses some doubts as to the permanency of one—the *Infusoria*—as a distinct primary division. Here we see carried out to its last term the tendency of the naturalists of the present day to subdivide, and, as it were, to look at nature by piecemeal. The same tendency is manifested in the students of a special order, or family, to multiply orders, families and genera to what seems to us an unwarrantable extent, and is as much due to the want of powers of generalization and combination as to the new facts and improved methods of study, which many claim make such innovations necessary. We are glad to see such iconoclasts arise, and doubts thrown

* An Introduction to the Classification of Animals, by T. H. Huxley, LL. D. London, 1869. 8vo, pp. 147. $1.50 gold.

over classifications usually accepted, and groups of facts broken up and scattered, believing that another master mind like Humboldt's, or Cuvier's, will arise in the years coming to recrystallize them and demonstrate anew the number and succession of the grand types of the animal kingdom.

Not agreeing with the view of Huxley, who would split up the Mollusca into two branches (believing that though degraded, the Ascidians, Brachiopods and Polyzoa are true mollusks) nor in the "subregnal distinctions of the *Cœlenterata*," which Frey and Leuckart have attempted to demonstrate, let us examine the author's views regarding the classification of the Cuvierian Articulata, and seek the reasons of his adopting Siebold's view that the Vermes (in the Linnæan sense) should be separated as a distinct subkingdom, equivalent to the Vertebrates for instance, and thus the Cuvierian branch of *Articulata* be demolished. In the arrangement of the classes of the Articulates, the author retrogrades nearly a quarter of a century, and in that of the Insects, more than that time. This is due perhaps to his having studied the members of this type less than the others, and being consequently dependent on the labors of other naturalists. The views of Leuckart, which have been so ably seconded by Professor Agassiz, that the Articulates should be distributed into three divisions, or classes, according as the body is worm-like, *i.e.*, a simple cylindrical sac, not subdivided into different regions, as in the Worms, or differentiated into two regions, as in the Crustacea; or three, as in the Insects, is founded upon a much broader and more comprehensive principle in the classification of these articulated animals than any the author suggests in this work. The body of the typical articulate is a cylindrical sac, subdivided by infoldings of the integument into more or less equidistant segments, and the form and relative position of the internal organs are subordinated to this articulated, or segmented, plan. This structure is shown in the higher Annelids, as well as in the Insects and Crustacea and though less frequently in the lower worms, yet in the tapeworm the body is distinctly segmented, and the Turbellaria are [illegible] allied to the segmented Leeches. Discophora to be placed in a separate subkingdom by a series of negative characters such as the author proposes. The Myriapods and Arachnida are considered as classes equivalent to the Insects and Crustacea. The direct homology of the [illegible] of Myriapods and Arachnids with the insects, and more especially [illegible] that the young of these two groups are, when first hatched, hexapodous, and that the embryology of the Arachnids is almost [illegible] with that of the insects, are not mentioned by the author. He [illegible] his subkingdom "Annulosa" into the *Arthropoda* [illegible] proposed by Siebold in 1848, and *Annelida*, for which we could never see a good reason, both Insects and Crustacea in their retrograde genera sometimes assuming worm-like forms, a proof of the unity of type in the three classes. The worms seem to us to stand in the same relation to the Insects and Crustacea, as the fishes do to the Mammalia.

Now in subkingdoms, as well as in classes and orders, or families and

genera, there are two series of forms, the higher and the more degraded. In the type of Articulates the Flea is a degraded Mycetophilid, so to speak; the Podura is a degraded Neuropterous insect; the Tardigrades, by some naturalists placed among the worms, are degraded mites, to be ranked near Demodex; as in suborders so in families, the wingless Boreus is a degraded Panorpa. There is the greatest range of form within these subdivisions, and we judge of the relationship and position in natnre of the lower by their relation to other and higher forms. Following out the principles of Prof. Huxley, by looking at the results of his methods of inquiry, we should go back to the times of the first quarter of this century, and assign the flea to a distinct order; also the Stylops, an undoubted Coleopterous insect, to a distinct order (as he really does). With as much reason does the author separate the lower worms (Annuloida) from the Annelida (in the Huxleyan sense), or separate the Echinoderms from the Radiata, and place them next to the Annulosa; and assign the worms to a division equivalent to the Insecta and Crustacea combined (Arthropoda). We would question whether this "conduces to the formation of clear conceptions in zoölogy." Rather do we think that it is a retrograde step to the pre-Cuvierian times of Linnæus and Lamarck, when the animal kingdom was a confused mass of classes and orders, with no glimpses of archetypal forms, or hints of an idea, or plan, combining these classes into grand types.

In the arrangement of the insects we are led back some thirty, or more, years to the times of Kirby and Spence, and Leach, though the author is probably indebted largely to Gerstaecker's classification, in Peters and Carus' Handbook of Zoology, representing, perhaps, the Erichson and Siebold school.

The Coleoptera are placed at the head of the Insects, and the Hymenoptera, Lepidoptera and Diptera are interposed between the beetles and the Hemiptera, though there is so much in common between these two last orders, and the Orthoptera and Neuroptera, in the structure of the imago. Beyond the Hemiptera all is uncertainty and confusion, and the toil of entomologists for the last thirty years seems in vain, as our author clings to the obsolete classifications of over a quarter of a century back. Prof. Huxley still retains the old orders "Strepsiptera" for the Coleopterous family Stylopidæ, in spite of the opinion of the ablest and most philosophical coleopterists of the present day; his characters defining the group being mostly negative.

The strangest, and humanely speaking, saddest feature of his classification is recognizing the Neuropterous family, Phryganeidæ, as an "order" (Trichoptera), when their affinities to the Panorpidæ are so well acknowledged by the best neuropterists. Why the Neuroptera (in the sense of Siebold and Erichson) are placed above the Orthoptera we are not told. The Orthoptera, according to Huxley, embrace, — *a*, the restricted Orthoptera (Cockroaches, Mantides, Leaf and Stick Insects, Grasshoppers and Locusts); *b*, the Dermatoptera (Forficulariæ); *c*, the Termitinæ (the Pso-

cidæ are not mentioned by the author); *d*, the Perlariæ; *e*, the Ephemeridæ, and *f*, the Libellulidæ. Three groups remain, "which do not fit well into any of the preceding assemblages,"—*a*, the *Physopoda* (Thrips) [which are simply degraded Lygæid Hemiptera]; *b*, the *Thysanura* [which are unquestionably degraded Neuroptera], and *c*, the *Mallophaga*, or bird-lice [which again are degraded Hemiptera and are so recognized by many eminent entomologists, beginning with Latreille.] This arrangement, so arbitrary and unphilosophical, the author evidently borrows from Gerstaecker in Peters and Carus' Handbook of Zoology. Again, for what reason are the *Arthrogastra* (Scorpio, Chelifer, Phrynus, Phalangium, and Galeodes) placed above the Spiders (Araneina), when structurally they are so obviously inferior to the latter, as the embryology of the two groups (of which not a word is said) decides with so much certainty?

We imagine the author treats that strange form, Sagitta, much as Thrips and the Case-flies are disposed of, because it does not "fit well" into some other order or class, not agreeing, forsooth, with the ordinary "definitions" of such order or class (these "definitions" are the bane of zoölogy studied as a science.) It is, indeed, thrown into a separate class, the *Chætognatha* of Rudolph Leuckart, and placed between the worms and Crustacea. Would it not be as philosophical to wait until the embryology of this singular form had been studied before isolating it from either the Crustacea (for it may turn out to be a Copepodous crustacean allied to Penella, as Prof. Agassiz has suggested) or the Annelida, where the weight of authority perhaps locates it.

This book, so interesting and suggestive, yet so unsatisfactory, marks a transitional era in zoölogy. Many of the author's views had been published long before the appearance of the present manual, but the volume has been received with such an unquestioning spirit by certain English reviews, that we must enter our protest against many of the author's opinions regarding classification; and if the Cuvierian "branches" are to be demolished, do let us have a reasonable classification substituted, instead of a confused mass of classes and orders, and almost entire disbelief in the existence of archetypal forms, and ideas in creation—for such surely is the tendency of the book.—*To be concluded.*

GUIDE TO THE STUDY OF INSECTS.*—This work, which has been over a year in going through the press, appearing in numbers, has at length been completed and issued from the Naturalist's Book Agency. It comprises 700 octavo pages, with 651 wood-cuts, and eleven plates, illustrating in all 1,238 objects. It is accompanied by a glossary of entomological terms, a calendar of the monthly appearances of insects, and a copious index. Regarding the classification adopted the author states in the preface:

"The succession of the suborders of the hexapodous insects is that proposed by the author in 1863, and the attention of zoologists is called to the division of the Hexapods into two series of suborders, which are characterized on page 104. To the first and highest may be applied Leach's

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* A Guide to the Study of Insects. By A. S. Packard, Jr., M. D. 8vo, pp. 700. 1869. Naturalist's Book Agency, Salem. Price, bound, $6.00.

term METABOLIA, as they all agree in having a perfect metamorphosis; for the second and lower series the term HETEROMETABOLIA is proposed, as the four suborders comprised in it differ in the degrees of completeness of their metamorphoses, and are all linked together by the structural features enumerated on page 104.

The classification of the Hymenoptera is original with the author, the bees (Apidæ) being placed highest, and the saw-flies and Urocerida lowest. The succession of the families of the Lepidoptera is that now generally agreed upon by entomologists. Loew's classification of the Diptera, published in the "Miscellaneous Collections" of the Smithsonian Institution, has been followed with some modifications. Halliday's suggestion that the Pulicidæ are allied to the Mycetophilidæ gives a clue to their position in nature among the higher Diptera. Leconte's classification of the Coleoptera is adopted as far as published by him, *i.e.*, to the Bruchidæ; for the succeeding families the arrangement of Gerstaecker in Peters and Carus' "Handbuch der Zoologie" has been followed, both being based on that of Lacordaire. The Hemiptera are arranged according to the author's views of the succession of the families. The classification of the Orthoptera is that proposed by Mr. S. H. Scudder. This succession of families is the reverse of what has been given by recent authors, and is by far the most satisfactory yet presented. The arrangement of the Neuroptera (in the Linnæan sense) is that of Dr. Hagen, published in his "Synopsis," with the addition, however, of the Lepismatidæ, Campodeæ and Poduridæ.

The usual classification of the Arachnida is modified by placing the Phalangidæ as a family among the Pedipalpi, and the succession of families of this suborder is suggested as being a more natural one than has been previously given.

The arrangement of the Araneina, imperfect as authors have left it, is that adopted by Gerstaecker in Carus and Peters' "Handbuch der Zoologie." In the succession of the families of the Acarina the suggestions of Claparede in his "Studien der Acariden," have been followed, and in the preparation of the general account of the Arachnids the writer is greatly indebted to Claparede's elaborate work on the "Evolution of Spiders."

Succeeding the preface a page or more is devoted to "acknowledgments," where the author gives the source of each figure in the work. This was the more necessary, as the plan adopted in the two first parts, of giving the name of the person from whose work the figure was borrowed was found to be too cumbrous and expensive.

The "Guide" is already in use in some of our principal colleges and agricultural schools as a text book, or for reference, and seems to have met with favor from teachers and naturalists. The first edition has been about exhausted, and a new one will be issued at an early date. The rapid sale of the book — the first edition being nearly exhausted before the issue of the last part — indicates the large number of lovers of entomology in this country, and the growing sense of the importance of the study of practical entomology by agriculturists.

ORIGIN OF THE BIG MOUND OF ST. LOUIS.* — Professor Spencer Smith, in a paper read before the Academy of Science of St. Louis, states that the noted "Big Mound," has at last been laid low, and its substance used to grade a railroad. The destruction of the mound gave an opportunity to study its structure, and Prof. Smith is satisfied that it did not belong to the group of artificial mounds, but was simply a river deposit, formed of parallel and horizontal strata of clays and sand, the same as found on the banks of the river. But few relics were found during the removal of the mound, and nothing, Mr. Smith thinks, that would indicate anything more than that the Indians took advantage of the mound to bury their dead as they would in any high place.

* Seven pages, 8vo, Oct., 1869. From the Author.

NATURAL HISTORY MISCELLANY.

BOTANY.

GEOGRAPHY OF PINUS PUNGENS.—In a note to a paper on "Variations in *Pinus* and *Taxodium*," recently published by the Philadelphia Academy of Natural Sciences, I have given another locality for them: "on the hills north of Harrisburg, along the Susquehanna," and they are probably abundant through the center of the State.—T. MEEHAN.

ZOÖLOGY.

DOES WITH HORNS.—The doe with horns, mentioned in the July number of the NATURALIST, must have been a very fine specimen, as well as a very marked example of the imperfect development of sex which sometimes occurs, and has been found by naturalists in all branches of the animal kingdom. I saw a few years ago a doe with a pair of horns; it was about eighteen months old, and was in an enclosure on Long Island. In the same enclosure was a buck of the same age; the horns of both animals were so nearly alike that they could not have been told apart. I have heard of others that have been killed in the Adirondacks, the horns being like those of the buck of the second or third year. They are known there as barren does.

The inability to produce young, however, seems to depend on the amount of masculine nature inherited, as the doe that I saw did have one fawn.

Martin says: "In domestic cattle, where the cow produces twins, one being a male and the other a female, the female calf is very apt to be barren, and the external form to resemble that of the ox. A calf of this kind is called a *free martin*, the origin of which name is however obscure. These calves on being slaughtered have been found to be hermaphro-dites."

I have seen a peahen that, after it had ceased laying, grew a pair of spurs. Darwin says: "It is well known that a large number of fem birds, such as fowls, various pheasants, partridges, peahens, ducks, e when old or diseased, or when operated on, partly assume the second male character of their species." "A duck ten years old has been kn to assume both the perfect winter and summer plumage of the dr "Waterton mentions the case of a hen that had ceased laying, and assumed the plumage, voice, spurs, and warlike disposition of the c thus every character of the male must have lain dormant in this h long as her ovaria continued to act."

The reindeer and caraboo are the only two species of the gen

vus, the females of which always have horns, though smaller than those of the male. Many instances are mentioned, however, of exceptions to this rule. Todd says: "Among the females of the lower animals a similar approach to the male character in the general system not unfrequently shows itself as an effect both of disease and malformation of the sexual organs, and also in consequence of the cessation of the powers of reproduction in the course of advanced age. Female deer are sometimes observed to become provided, at puberty, with the horns of the stag, and such animals are generally observed to be barren, probably in consequence either of a congenital or acquired morbid condition of their ovaries or other reproductive organs. This occurs sometimes also in old age, and, according to Burdach, when the doe has been kept from the male, and at the same time furnished with abundant nourishment.

"In a kind mentioned by Mr. Hay, and which, he believed, had never produced any young, one of the ovaries, on dissection after death, was found to be scirrhous. The animal had one horn resembling that of a three years' old stag, on the same side with the diseased ovary; there was no horn on the opposite side. "In a number of instances where female pheasants had assumed more or less the plumage of the male, the ovaries, on dissection, were found to be diseased." "On the other hand, with male animals it is notorious, that the secondary sexual characters of the male are more or less completely lost when they are subjected to castration." "If this operation is performed on the cock, he does not crow again; the comb, wattles and spurs, do not grow to their full size. The capon takes to sitting on eggs. So it is with hornless cattle, some of which, as they grow old, acquire small horns. "Why in the female, when her ovaria becomes diseased or fail to act, certain masculine gemmules become developed, we do not clearly know any more than why, when a young bull is castrated, his horns continue to grow until they almost resemble those of the cow; or why when a stag is castrated the gemmules derived from the antlers of his progenitors quite fail to be developed."

I have had an opportunity of studying four cases of this kind; one that of a *Cervus Virginianus* castrated when young, has never developed a perfect pair of horns, the first spike of the deer of eighteen months old has never been shed, the original velvet remaining upon it, and a succession of points have been thrown out from the base until the appearance has become like that of two rosettes on his head. Two Wapiti deer that were castrated in September, several years ago, while their horns were full, cast their horns two weeks after the operation, when they would not otherwise have cast them until January or February. The horns immediately began to grow and have never been cast, the velvet has remained on ever since, while the form is very irregular and imperfect. Mr. J. G. Bell informs me that some years since he found a *doe* with horns as large as those of a buck of two years.

I have in my collection the skull and horns of a Wapiti that had been

castrated. They are in the velvet, are heavy and thick, and the branches instead of being pointed are palmated, the palmations being seven inches broad on some of the branches. It is to be hoped, that as public parks and zoölogical collections are being made throughout the country, more attention will be paid to these subjects in this country, and better opportunities afforded to the naturalist than can be had in the woods while hunting.—W. J. Hays.

The Egg of the Great Auk (*Alca impennis*).—Dr. Baldamus announces as the result of recent investigations, that but four eggs of this species are to be found in Germany (one belonging to the Grand Duke of Oldenburg, one to Count Rödern in Breslau, and two to the Royal Museum in Dresden), none in France, two in the Copenhagen Museum, and about sixteen in England, making twenty-two. The Academy of Natural Sciences in Philadelphia had two specimens, but, with praiseworthy liberality, has recently presented one to the Smithsonian Institution. So far as positively known, therefore, less than thirty specimens of the egg of this probably extinct species, are now preserved. The exact number of preparations of the bird itself we are not at present prepared to give. Only three, however, are to be found in America, one each in the Museums of the Academy of Natural Sciences of Philadelphia, of Vassar College, Poughkeepsie, and of the Smithsonian Institution. Of the Skeletons only two are known, one in the British Museum, and the other in the Cambridge Museum of Comparative Zoölogy. Detached bones are, however, found in more or less abundance in the ancient shellheaps of Denmark and other parts of Europe, and of the New England and Nova Scotian Coasts.*.*

The Cow Bunting.—Mr. Martin Trippe, in his article on the Cow Bunting, (*Melothrus pecoris*) in the August number of the Naturalist; mentions his having heard of but two instances where this bird deposited more than two eggs in a single nest.

On the 15th of May, 1868, I found a nest of the White Crowned Sparrow (*Zonotrichia leucophrys*), of two stories; containing, in the under, a single egg of the Cow Bunting, and in the upper, two more of the same, together with three of the rightful owners. These were being sat upon at the time by the female bird, and on blowing proved to be pretty well advanced in their incubation. Again, this last spring, in the month of May, I found a common Pewee Flycatcher's nest, containing, with three of its own, also three of the Cow Bunting's eggs. One of these last was so forced down into the bottom of the nest as to be almost covered up. This nest I have now in my collection. — H. S. Kedney, *Potsdam, N. Y.*

The House Fly.—Years ago I had hundreds of house flies. I think that the perpetuity of the race is provided for in the larval and pupa state over winter, and not by hibernating as adult flies. I have seen the greatest abundance of pupæ late in autumn, when I am confident they did not then transform. — H. Shimer.

A SINGING MOUSE.—Within the last year I have seen several items in the papers, to the effect that "singing mice" had been caught in different parts of the country, and as the existence of such musicians seems to excite interest, I propose to give an account of one that lived with us about two years ago.

It was in September, 1866, at Newburgh, N. Y., I had noticed in one of the rooms occupied by my family, for several evenings, a fine, chirping sound, so persistent and monotonous as to be annoying, and had supposed it to proceed from one of the small cicadæ that, at that season, had full possession of the shade trees that surrounded the house. Several times I endeavored to find the insect, but ineffectually, the noise seeming to come from different parts of the room, sometimes high in the wall, sometimes on the floor, and ceasing altogether while I was endeavoring to localize it, only to break out afresh the moment I resumed my seat and the room was quiet. This continued more or less for a week, without my being able to learn whence the sound proceeded. At last it invaded my bedroom, which adjoined the other, and for an hour or two together, on one particular night, made sleep impossible. It chanced next morning as I was dressing, the same note issued from an enclosed verandah, the doors of which were open. It struck me as odd that an insect, such as I supposed the musician to be, should sing by daylight. Upon the floor of the verandah were several trunks, and I traced the sound from one to another, till, on lifting gently the lower edge of the canvas cover of one of them, I saw the tail of a mouse protruding. He scampered away to another hiding place, from which forthwith the same notes came. I left the mouse in peace that day, but devised means to entrap him the following night. And sure enough, somewhere about midnight, I waked to hear the same continuous chirping, and presently heard the click of the trap. In the morning the children were greatly excited, and soon found an old dormouse cage, brought from London years ago, made like a squirrel cage with wheel and sleeping box, but all on a scale suitable for mice or dormice, which are alike feeble folks. The captive seemed pleased with his quarters, and soon manifested his content at the quality and regularity of his rations, by singing his unvarying tune at all hours. He warbled after the manner of a minute bird, the throat swelling and vibrating, the mouth closed or nearly so, and the lips in incessant rapid motion, like those of a rabbit. There was nothing like the imitation of any particular bird. We might possibly have fancied otherwise if there had ever been a canary in the house. Nor was there anything that could strictly be called a song. The sound was thin, sharp, but slightly varied, and altogether more like that emitted by an insect. This mouse soon became very tame and familiar with the presence of any of the family. After a few days he became much less restless than at first, was visibly getting fat and lazy, would not take a run in the wheel unless driven to it, and spent a good part of the day sleeping in his little room. In this he hoarded his food in such quantity as to seem to the children

uncomfortable, and therefore he occasionally had to be ejected while his bedding was changed and all made clean. At this treatment he would manifest his displeasure by flying across the cage into the wheel, which he would make spin, emitting all the while his peculiar note with great shrillness and rapidity. And when admitted again after the house clearing, he would be in a state of exasperation, scolding incessantly while busy rearranging things to suit his own mouse ideas. Several times he escaped from the cage, but was as often retaken, as his noise always betrayed him, until at last, after he had been with us six weeks, he escaped once too often and we saw him no more. We supposed he had found his way through the open door into the garden. This mouse was not the common house-mouse, but of a species which frequents barns or lives in the fields, and which was common in our own barn. It was of a light brown, with a whitish belly. Its nose was sharper than that of the house-mouse. On mentioning the subject to a friend, I was told that, some years ago, a house in Catskill, N. Y., was greatly infested with "singing mice," and that it was well known and talked of in the village.

We know so little of the habits of the small nocturnal animals, that it may be possible that these field-mice possess more or less of the musical faculty. The notes of the subject of this paper would pass for the chirping of a cricket, or small grasshopper if heard in the open air, or even in a barn. If heard in a room they would have a certain distinctness, but could not properly be likened to anything so decided and modulated as the song of a bird.

I have looked in vain for any intelligent account of the habits of our field-mice in works of Natural History. In Jesse's "Country Life," London, page 350, is mentioned as follows: "I have been twice to hear the singing mouse. Its song is plaintive, sweet and continuous, and evidently proceeds from the throat. The notes are those of a canary bird, and on questioning the man, I found that one of these birds had been kept in the room in which the mouse was trapped?"—W. H. Edwards.

Natural Selection, a Modern Instance.—I am a frequenter of the Adirondacks, having hunted there for twenty-one years. The common American Deer (*Cervus Virginianus*) abounds there. About fourteen years ago, as nearly as I can remember, I first began to hear of "Spike-horn Bucks." The stories about them multiplied, and they evidently became more and more common from year to year. About five years ago I shot one of these animals, a large buck with spike-horns, on Louis Lake. In September, 1867, I shot another, a three years old buck with spike-horns, on Cedar Lakes. These Spike-horn Bucks are now frequently shot in all that portion of the Adirondacks south of Raquette Lake. I presume the same is true north of Raquette Lake, but of this latter region I cannot speak from personal observation, having visited it only once.

The spike-horn differs greatly from the common antler of the *C. Virginianus*. It consists of a single spike, more slender than the antler,

scarcely half so long, projecting forward from the brow, and terminating in a very sharp point. It gives a considerable advantage to its possessor over the common buck. Besides enabling him to run more swiftly through the thick woods and underbrush (every hunter knows that does and yearling bucks run much more rapidly than the large bucks when armed with their cumbrous antlers), the spike-horn is a more effective weapon than the common antler. With this advantage the Spike-horn Bucks are gaining upon the common bucks, and may, in time, entirely supercede them in the Adirondacks. Undoubtedly the first Spike-horn Buck was merely an accidental freak of nature. But his spike-horns gave him an advantage, and enabled him to propagate his peculiarity. His descendants, having a like advantage, have propagated the peculiarity in a constantly increasing ratio, till they are slowly crowding the Antlered Deer from the region they inhabit.

Suppose this had begun several hundred years ago, and the process had been completed before the first white man penetrated the wilds of northern New York, the first naturalist visiting the region would have found of deer, besides the Moose and Caribou, only the Spike-horn. Would he have hesitated to have pronounced it a distinct species, and to have named it as such? And would not naturalists everywhere have followed him? Yet the Spike-horn Buck is but an accidental variety of the *C. Virginianus*. Is it probable that the Black-tailed Deer is a more distinct species? How many changes as great as that from the common Deer to the Spike-horn Buck would be necessary in order to produce an animal as different as the Elk, or even the Moose?—ADIRONDACK.

"LILIES OF THE ROCKS."—An article in the August number of the NATURALIST entitled "The Lilies of the Fields, of the Rocks and of the Clouds," contains statements which show the author to have misconceived some very plain zoölogical facts. I allude to his assuming that the hexagonal form of the "microscopic blocks" which constitute a layer of the retina of the eye; and the similar outline of plates of fossil crinoids, are facts which illustrate a natural law similar to that which governs the crystalization of snow-flakes and of certain mineral substances, and which he claims the ability to explain by a new theory of his own.

With no reference to his theory, and no desire to criticise the author unjustly, I merely wish to state that zoölogists have long had what is to them a sufficient explanation of the cause of the forms assumed by those parts of the "animal frame" referred to by him in the article just mentioned. They believe that the normal form of those microscopic bodies which enter into the structure of the retina of the eye is spherical, and that they receive their hexagonal outline by impinging against each other in their crowded condition. So also the plates of all plated Radiates receive their polygonal outlines from the same cause. Their normal outline is circular and undivided, evidence of which may be seen in the inner circular lines upon the very figures of a plate of *Archæocidaris* which he reproduces from Hall, and which by the way is not a crinoid. These

plates commence calcification within the skin of the young Radiate as circular grains, and increase at their periphery until they impinge against contiguous plates; the number of angles they may have when fully grown being determined by the number of other plates they impinge against. The plate he figures happens to have six, but many others upon the same individual had a different number and their angles were often unequal in the same plate. The hexagonal outline of the microscopic bodies in the retina is uniform in all because they are uniform in size and consistence. The plates of Radiates are not uniform because their points of calcification are usually located at unequal distances. By this it will be seen that the number of angles any plate receives is essentially accidental and bears no relation whatever to the fundamental plan upon which the animal is constructed, which is that of five rays and not six, the number necessary to make it harmonize with the crystalline structure of snow-flakes, etc. — ZOÖLOGICUS.

SAGACITY OF THE PURPLE MARTIN.—In the spring of 1868, a young friend of mine in this city desiring to obtain eggs of the Purple Martin, constructed a nesting-box and hung it out of the window. This box had a hole on the outside for the entrance of the birds, and a hole on the inside through which to reach the hand and remove the eggs. The birds at once appropriated the box, and he succeeded in procuring specimens of the eggs.

This spring (1869) the birds again built in the box, and having secured his eggs, my friend concluded to preserve a specimen of the birds. He reached through the back hole in the box and seized one of the birds, and killed and mounted it. The mate was absent for a day or two, when it returned with a companion, and both birds built a mud wall, shutting up the back hole into the box from which a bird had been taken, and then went on and raised a brood of young. — D. D. HUGHES.

THE CAPTURE OF THE CENTRONYX BAIRDII AT IPSWICH.—On Dec. 4th. 1868, I shot a sparrow that was new to me, on the sandhills at Ipswich. Through the kindness of Prof. S. F. Baird, of the Smithsonian Institution, to whom I sent it for comparison with the *only extant specimen* of the *Centronyx Bairdii* (which is owned by him), it has been proved identical with that collected by Audubon in 1843, on the banks of the Yellowstone River, in the far West.

My specimen differs somewhat in size and general coloration from Prof. Baird's. A detailed description, and the comparative measurements of the two specimens, will be given in a work about to be published, entitled "A Guide to Naturalists in collecting and preserving objects of Natural History," which will also contain a complete list of the birds of Eastern Massachusetts, with critical notes and remarks relative to the localities in which some of the rarer species occur. A life-sized engraving of the *Centronyx* captured at Ipswich will also be given.

I was much interested in a discovery that I made relative to the length

of the claws of the Mud-turtle (*Chrysemys picta* Gray) differing in the sexes. I have examined a large number and found in every case that the claws of the males on the front feet are nearly *twice as long* as those of the female. If we take into consideration the manner in which these animals copulate the reason of this peculiar elongation of the claws of the male is obvious. — C. J. MAYNARD.

PROLIFIC SNAKES. — Various accounts of prolific snakes, from Lancaster County, have come to me during the present season. On the 6th of August a female snake, *Heterodon platyrhinus*, commonly known in this locality as the "Blower," or "Blowing Viper," was killed in Martic Township. From a wound in her side, over one hundred young snakes, from six to eight inches in length, came forth, all very active, all blowing, and flattening their bodies, as is common in the adult individuals of this species. Sixty-three of these young snakes were brought to me in a bottle of alcohol, thirteen were too much lacerated to make good specimens, and the remainder made their escape before they could be secured. We *know* this species to be oviparous. The question now arises again, "Do female snakes, in certain contingencies, swallow their young?" as has so often been confidently asserted, and as often and as strenuously denied. Mr. Lehman, an intelligent farmer, who was present at the killing, and who brought me the specimens, says that they seemed to issue from an abdominal sack, which was ruptured in the act of killing. An opinion obtains in some quarters, that the same species, under certain circumstances, may be either oviparous or viviparous, or "ovoviviparous," as it is sometimes called. — S. S. RATHVON, Lancaster, Pa.

THE HALIOTIS OR PEARLY EAR SHELL.—In an article, with the above title, in the July number of the NATURALIST, referring to the geographical distribution of the Haliotides, I have stated as a remarkable fact, that although several species are found upon the West coast of North America, not a single species had been found upon the East coast of either North or South America. In the latter part of August, upon the occasion of a brief visit to the Museum of Comparative Zoölogy at Cambridge, I was kindly shown by Count Portales, among other material, a specimen of Haliotis (some one and one-half inches long) dredged, *living*, by him in the Gulf Stream between Florida and Cuba; this is the first instance of the occurrence of the Haliotis upon the Eastern side of the American Continents. — R. E. C. STEARNS.

COW DEVOURING THE PLACENTA. — In the June number of the NATURALIST, in the Scandinavian *compte rendu*, some investigations in regard to animals devouring their after-birth are referred to as novel and interesting. If this be the case, I suppose individual testimony to the same effect may be worth something, and I write to say that I once knew a cow to devour her after-birth, at least so much of it as she was permitted to eat. I have also known cats to go a step farther, and devour the new-born litter. — P.

THE WORM-EATING WARBLER.—In looking over the description of the Worm-eating Warbler (*Helmitherus vermivorus*), in the "Birds of New England" by Mr. Samuels, I see he describes it as nesting in bushes from four to nine feet from the ground, and making its nest with the blossoms of hickory and chestnut trees. I should like to know if these are the usual habits of this bird.

On the 6th of June, 1869, I found a nest of this species containing five eggs. It was placed in a hollow on the ground much like the nest of the Oven bird (*Seiurus aurocapillus*), and was hidden from sight by the dry leaves that lay thickly around. The nest was composed externally of dead leaves, mostly those of the beach, while the interior was prettily lined with the fine thread-like stalks of the hair moss (*Polytrichium*). Altogether it was a very neat structure, and looked to me as though the owner was habitually a ground-nester. The eggs most nearly resemble those of the White-bellied-Nuthatch (*Sitta Carolinensis*), though the markings are fewer and less distinct. So close did the female sit that I captured her without difficulty by placing my hat over the nest. — T. H. JACKSON, *Westchester, Pa.*

FALL OF SHELL-FISH IN A RAIN STORM.—Mr. John Ford exhibited to the Conchological Section, Academy of Natural Sciences, Philadelphia, specimens of *Gemma gemma*, remarkable as having fallen accompanied by rain, in a storm which occurred at Chester, Pennsylvania, on the afternoon of June 6th, 1869. The specimens were perfect, but very minute, measuring one-eighth inch in length by three-sixteenths inch in breadth. Though most of the specimens which fell were broken, yet many perfect ones were collected in various places, sheltered from the heavy rain which followed their descent. A witness of the storm, Mr Y. S. Walter, editor of the "Delaware County Republican," assured Mr F. that he noticed the singular character of the storm at its very commencement, and to use his own words, "it seemed like a storm within a storm." A very fine rain fell rapidly, veiled by the shells, which fell slower and with a whirling motion. Judging from the remains of animal matter attached to some of the specimens, together with the fresh appearance of the epidermis, it is highly probable that many of them were living at the moment of transition. This minute species resembles a quahaug shell, and is common on the seashore between tide marks.

NYCTALE ALBIFRONS. — I do not know whether, since the discovery made by Dr. Hoy, of Racine, Wisconsin, in regard to *Nyctale albifrons*, another of this beautiful and rare species has been taken within the limits of the United States. A few days ago a live and well plumaged specimen was captured in the centre of the city of Buffalo, by George L. Newman, Esq., of that city, and presented to the Society of Natural Sciences. I am sorry to add that the bird lived only two days in captivity, and it forms now a very valuable addition to the ornithological collections of the Society. — CHARLES S. LINDEN.

A FIDDLER-CRAB WITH TWO LARGE HANDS. — A male "Fiddler" with nearly equal hands has recently been presented to the Museum of Yale College, by Mr. W. C. Beecher, who collected it near this city. It does not appear to differ from the common *Gelasimus palustris* except in the right cheliped. The left cheliped is exactly like the larger cheliped of ordinary specimens, while the right one differs only in being a very little smaller, and in having the fingers slightly more incurved at the tips. In this character of equal chelipeds it agrees with the genus *Helœcius*. The specimen was very lively, and used both hands with equal facility. — S. I. Smith, *New Haven, Conn.*

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

CHICAGO ACADEMY OF SCIENCES. *Meeting of October 12th*, 1869. — The President exhibited some implements of stone and shell, forming the surgical kit of an Apache Medicine-man, killed in a recent skirmish with United States troops. The stone implements were all of carbonate of lime cut from a beautifully striped stalagmite. Four of them apparently constituted a set of tamponers, the slender flattened ones being used for plugging wounds made by arrows, and a larger cylindrical one for gun-shot wounds. The surgery of the Apaches is based upon the idea that the chief danger of a wound is from the loss of blood, and plugging, aided by incantations, etc., constituted the whole of their resources. One of the stones is probably a charm, as it represents an animal, probably the Texas Armadillo, and it is ingeniously cut, so that the bands of color correspond to the transverse rows of scales. The shell is a large Oliva from Lower California, perforated and suspended by a string.

Dr. Stimpson gave an account of his experiments, during the last three months, upon a solution of carbolic acid as a substitute for alcohol in the preservation of wet specimens. The results had been gratifying, and promised a relief from the chief burden of expense in carrying on large zoölogical museums. He found that deliquesced crystals of the acid dissolved in forty times its bulk of water gave a fluid which equalled alcohol, in its preservative qualities, at less than one-twentieth the cost, with the additional advantage of keeping the specimen far more nearly in its original condition, as to the color, etc. And very curiously (this is, however, not enumerated among the advantages) the peculiar smell of the fresh fish is retained in specimens of trout which had been kept for several weeks in the fluid. The qualities of the substance (more properly an alcohol than an acid), which is a great enemy of all protozoic and protophytic life, depend upon its powerful action in destroying the germs associated with, if not the cause of, decomposition. In a solution of

twice the strength above mentioned — the saturated solution — the specimen itself is soon destroyed. Specimens should be first placed in a very weak solution, say one-half per cent., but as the action of the acid is very rapid, it may be daily changed for a slightly stronger one, until the full strength (two and one-half per cent.) is reached. This should be done to prevent the contraction resulting from the sudden contact of a strong solution, and preventing endosmosis. Fluids once used will be found to have lost their preservative power in a considerable degree far more than in the case of alcohol, and must be strengthened before being used again. After specimens have been completely permeated with the solution, say in three or four weeks, they may be kept in pure water for a considerable length of time without showing signs of decay. A fluid containing one-half per cent. of the acid will probably be found sufficiently strong for the permanent preservation of specimens previously prepared in the stronger solutions and kept in tightly closed jars. The freezing of the fluid may be prevented by the addition of one-eighth part of alcohol, which will be found sufficient for the extreme of temperature to which museum rooms are ordinarily subject in this country. If the smell of the carbolic acid, which is very slight in the weak solutions, should be objected to, the addition of a minute quantity of the oil of wintergreen will cover it completely.

Carbolic acid will be found valuable on expeditions for zoölogical purposes, where the transportation of the necessary alcohol has heretofore formed a heavy item of expense. A few pounds of the crystals may be carried in a trunk, and be always at hand for use. Large fishes, etc., should be injected with the fluid in the mouth, intestine and cavity of the abdomen, and if possible in the larger blood-vessels. Inferior qualities of the acid may be obtained at a low price, and a clear solution obtained therefrom by filtering. The solution is an excellent thing for filling up old specimen jars from which the alcohol has nearly evaporated. All germs of mold are instantly killed, and the specimen needs no other preservative.

The experiments mentioned above were to be continued, with the view of ascertaining whether the solution was equally reliable for a longe[r] period.

Specimens were exhibited illustrating the preservative qualities of t[he] fluid.

Dr. Stimpson also made some remarks upon the shell-mounds of W[est] Florida, particularly those of Tampa Bay, which he had examined du[ring] the past winter and spring. These mounds were of great extent, s[ome] covering many acres of ground, and reaching a height of forty or [...] feet. Some of them were distinctly stratified, which characteristi[c] probably misled the only scientific writer* who has as yet men[tioned] them, and caused them to be regarded as of natural formation.

* Conrad, American Journal of Science, [2] I. 1846. ( ) p. 44.

The largest of these mounds are peculiar in their character, differing from any shell-mounds yet described. They are not *kjœkkenmœddings*, *i. e.*, simple accumulations of kitchen refuse, of shells rejected after the consumption of the soft parts, but seem to have been built for a purpose; shells being used as the most convenient materials at hand. They have even been increased in size, and raised in height from time to time, as evidenced by the occurrence at different levels of dark colored strata of true kjœkkenmœddings; charcoal, bones, pottery, such as implements of shell, etc. The masses of shells between these strata are entirely free from such materials, and are always four or five times as thick as the dirt bed. The shells, too, are not such as indicated merely the *rejectmenta* of aboriginal feasts, being of all sizes from that of *Littorina* to that of *Busycon*, and often showing evidence of having been dead when placed in the mound; some, indeed, showing remains of barnacles attached to their inner surfaces. Dr. S. believed these mounds — some of them at least — to have been built as places of refuge during the great inundations of the sea to which the coast region of West Florida, for miles inland, is even now subject in violent storms. The additions to the mound made by the people who dwelt upon them may have been occasioned by the occurrence of an inundation of greater height than was known in their previous experience.

Fig. 84.

Dr. S. exhibited a number of specimens taken from a dirt-bed in the mound at the mouth of the Manatee River. This bed was three feet in thickness, and indicated a long residence of the aborigines upon that level of the mound. The bed occurred about midway between the base and the summit of the mound, which was over thirty feet in height. The specimens consisted of bones of fishes, of loggerhead turtles, and of manatees; pieces of coarse, unadorned pottery, and implements made of shell. One of the most curious of the latter was a kind of augur, more than a foot in length, made of the axis of *Fasciolaria gigantea*, by knocking or grinding off the whorls and planing down one side of the handle. The use of this kind of implement is difficult to conjecture. Six of them were found lying together in a kind of pocket beneath a mass of charcoal. An interesting point is that no *stone* implements occurred in this dirt bed, while they did occur in another bed near the summit of the mound, perhaps indicating an advance in civilization. For the specimens exhibited the Academy was indebted to Mr. E. W. Blatchford, who had defrayed the expenses of excavation.

In the shell-strata of the mound the most abundant species were *Ostrea Virginica*, *Callista gigantea*, *Mercenaria præparca*, *Mactra Ravenelii*, *Cardium isocardia*, *Busycon perversum*, *B. pyrum*, *Strombus alatus*, *Natica duplicata*, *Cassidulus corona*, *Fasciolaria tulipa*, *F. gigantea* and *Oliva litterata*. Some of these shells now occur rarely if at all in the vicinity of the mound, while they are very abundant on the barrier islands of the

coast, and in the purer waters of the open gulf. These islands, doubtless, at the epoch of the building of the mounds were of smaller extent, and formed a less considerable bar to the approach of pure sea-water to the coast of the main land.

Major Powell then gave a brief account of his recent exploration of the grand Cañon of the Colorado River, and of the language of the Ute Indians, promising a more detailed account at some future meeting.

Dr. Durham exhibited under the microscope the tongues of several species of aquatic gasteropods found in the vicinity of Chicago, and described the habits of the animals.

ANSWERS TO CORRESPONDENTS.

E. S. M., Wading River, N. Y.—Your plant appears to be *Epiphegus Virginiana* Bart., known as Beech-drops or Cancer-root. It is certainly rare, except in the shade of beech woods, where it is usually common enough. It will be interesting to note whether you found it under this or some other tree, as it is supposed to be parasitic on the roots of the beech only. This species is *E. Americana* Nutt., and there is another related plant known also as Cancer-root, and found under the oak.—C. M. T.

W. W. B., Indianapolis, Ind.—Your No 9 is *Pteris critica* variety *albo-lineata*; No. 10 is *Pteris serrata*; the fertile frond, No. 11, is *Adiantum pubescens*.—J. L. R.

E. L. G., Decatur, Ill.—To form a satisfactory judgment upon your oak from the leaves only, is perhaps hardly possible. You omit to state what is the form of the acorns, and particularly whether they ripen the first or second year, which is a very important character. The size of the tree, and the nature of its habitat, as wet or upland, would be valuable criteria. In the absence of these facts, we should suspect, if the fruit ripens the first year, that it was a form, peculiar perhaps, of *Q. castanea*, Willd.; or, possibly, it may be *Q. monticola*, Mx. If the acorns remain over, then it may be a hybrid, as you suggest; and perhaps the curious *Q. tridentata*, Engelmann, though this we should doubt. The study of these natural hybrids is very interesting, and we would recommend you to make your observations as careful and comprehensive as possible.—C. M. T.

BOOKS RECEIVED.

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THE

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SHAVINGS EXAMINED MICROSCOPICALLY.

BY PROF. A. M. EDWARDS.

THE examination of any organic tissue, be it animal or vegetable, by means of the modern achromatic microscope, reveals such a world of beauty, and so much material for wonder, that the novice in such pastime is for a while very much puzzled what to observe, and what to leave unseen. Although life, that mysterious manifestation of Divine will, appears to be most strikingly made manifest in animal existences, yet the grass of the field and wood of the oak tree present materials attractive to him who will patiently read aright the lessons they inculcate. It is my intention, in the present article, to point out to the young student of nature a path that may be traversed with great profit and lasting pleasure. I have taken as my subject the structure of wood, the hard tissue of plants, as exhibited in the shaving which the carpenter peels off with his jack-plane. Let the embryo microscopist collect a number of such, the thinner the better, and I warrant he will have enough to do when looking at them through the long winter's evenings.

All plants, it has been discovered, great and small, the monarch of the woodland and the violet of the plain; aye, all, with the exception, perhaps, of those doubtful little

organisms that puzzle and delight the students of atomies, and which are grouped under the great collective head of the *Protophyta*, are constructed after the same general plan, and consist of the same chemical substances, congregated together after similar types, varying only in degrees of complexity. And what is an equally, if not more remarkable fact, those substances which go to make up the bulk of the vegetable organism are found also in the animal, constituting the elementary components of its body likewise.

However it is not our intention, at the present time, to enter into the consideration of the chemical constitution of vegetable tissues; interesting as that branch of vegetable physiology is, we must forbear, and, assisted by the microscope, proceed to the examination of those tissues themselves. The general structure of all plants consists of a substance known to chemists under the name of cellulose, the wall-matter of cells, so to speak; cells being the most important part of plants, as we shall see presently. It is this cellulose that we are so well acquainted with under so many different forms and names and constituting vegetable fibre, bark, the great mass and harder portions of all leaves, flowers, fruit and stems; and, although in special cases we find it somewhat modified, it is always to be recognized from its possessing certain unmistakable characteristics, familiar to all in the substance of paper, and, therefore, of course, in the linen or cotton, the wood or the straw from which the paper was made, so that we say that about all the paper we see is composed of cellulose in almost a pure condition, there being but little used which is manufactured from animal tissues, such as wool and silk. The rice-paper of the Chinese is not, as is generally supposed, made of rice, but of the light and porous pith of a plant which has been cut in the form of a broad strip, around and around the mass of the tissue, as is plainly seen when a small piece is examined by means of a magnifying glass, when the little cells or cavities which made up the pith are very evident. Woody

tissue is made up for the most part of this cellulose, arranged in different forms, all, however, derivable from the simple sac or cell, which is the basis and foundation, morphologically, of the whole vegetable kingdom; being found in its simple and uncomplicated form in the *Protophyta*, or first plants, we have mentioned, and modified in outline to a greater or less degree in the different parts of the tree, stem, leaves, and flowers. There is a doubt, however, in the minds of some physiologists as to whether the hard parts of plants are made up of this substance cellulose, or a modification of it termed "lignine." This point is one which we will not consider, as it is extremely doubtful if either of these two compounds has been obtained pure and separate from the other.

If a slice be made with a very sharp knife of some ripe fruit, as an apple or an orange, it will be observed on viewing such a section by means of the microscope, that it is made up of almost symmetrical and equal sized little sacs or cells, as they are called; and such simple tissue is known as cellular tissue. But if a similar slice be made of such hard matter as wood, a very different appearance will present itself to our eyes. First, however, so as to make ourselves acquainted with the manner in which such simple cellular tissue (where the elementary sacs merely touch each other with very little mutual pressure) passes into the more complex woody tissue, take a similar slice from the stem or young rootlet of some herbaceous plant, as the garden rhubarb or other common vegetable. Such a slice, made as thin as possible, is now placed in a little water upon a glass "slide," and, with a thin "cover" over it, examined by means of a microscope which does not magnify too strongly. We now see that the tissue in this case is cellular, as well as that in the fruit, but that the individual cells have become much altered in appearance from mutual pressure, which in some cases has been equal upon all sides, in others greater in certain directions than in others. So they have been crowded

upon each other until they have lost their almost spherical outline, and flat sides have made their appearance. We may illustrate the form of vegetable cells by blowing soap-bubbles with a tube. As long as we blow but one bubble at a time, they remain spherical in form and represent the simple *Protophyta*, but if we blow one after another until a string of them remain pendant from the tube we have a representative of the slightly more complex plants growing submerged in water and known as algæ. By placing the tube beneath the surface of the soapy liquid contained in a bowl and blowing we form a number of bubbles, which, on account of their being confined within the bowl, press upon each other almost equally and become many sided. The form that thus results is found on examination to be of a more or less perfectly geometrical outline, and such a mass very strikingly represents the cellular tissue we are examining, but to make it look still more like our section, we press a glass plate down upon the mass of bubbles, and thus we have the cavities cut across. But one other fact will be noticed through the glass plate, and that is that the bubble sections are for the most part six-sided, and such is also the case with the plant cells. This is the result of cutting through the regular geometrical form always caused by the mutual equal pressure of many spheres. In honeycomb we have another illustration of this fact; there the pressure has apparently been unequal, and the cell has become elongated into a six-sided prism. A precisely similar mode of aggregation is to be observed in vegetable tissues, and may be made evident by cutting two sections at right angles to each other. Such slices are known to microscopists as longitudinal and transverse sections; the first, in the case of wood, being taken lengthwise of the stem or branch, and the other across it. As the pressure is generally very unequal, perfect forms of the cells are the exception, and therefore the variety of outline of cells in vegetable tissues is very varied, that which is hexagonal being the most common. As a plant

grows, the number of cells is multiplied, and as the growth is faster in one direction than in others the resulting cells are elongated; in fact we find in woody tissues that the so-called wood cells are more or less fibrous, so that such tissue is known as woody fibre. These wood-cells are pointed at both ends, in fact are fusiform. Some of the cells, however, become united by the absorption of their contiguous walls, so that continuous tubes are formed. These tubes are for the purpose of transporting the life-blood of the plant (the sap), which like the blood of the animal, is the source of the new tissues which are built up from its matter. As these tubes are of such importance in the economy of the individual, it becomes necessary that they should be protected from injury, and such injury is most likely to be a crushing from without and a consequent stoppage of the flow of the sap. If we were to stop the flow of the blood in the arm, for instance, by tying a ligature above the elbow, we should find that disorganization of the tissues in the fore-arm and hand would result; they would mortify and death of the parts would follow. The same thing we can readily understand would take place in the plant, should the sap-flow be arrested in any way. To prevent such a disaster these long tubes are strengthened in a very remarkable manner, namely, by having a deposit of tough lignine formed within their walls, and arranged in the form of a spiral. The same mode of structure is to be seen in the tubes called tracheæ, which convey the air to and from the lungs of animals. Insects exhibit this structure in a very striking manner; the tracheæ of a caterpillar of some kind, most commonly the silk-worm, is a favorite microscopic object. The spiral arrangement at the same time permits of a certain amount of elasticity in such vessels, as is to be seen in a very common illustration of such structure. I allude to the flexible tubing used to convey burning gas from a chandelier to a burner upon the table. Such spiral ducts, as they have been named, are to be seen in most cross

sections of wood, and in our plate are represented by the largest openings. In some of the succulent plants, however, they are to be seen in a more striking manner. It is only necessary to tear a stalk of rhubarb or celery apart to find that fine fibres appear which are the last things to be ruptured; these are the spiral ducts, and constitute the "stringiness" of old specimens of vegetables. In our wood shavings we also observe other points of interest, more especially if the sections be cut across the "grain" or direction of the main growth. First let us examine the upper of our figures (Pl. 10, fig. 1), which represents such a slice cut from a stick of oak. This has been taken from a common kind of wood and well representing the grand group of plants to which it belongs, that is to say the *Exogens*, or outside growers. Our lower figure, on the other hand, represents a section of a stem of sugar-cane, showing the mode of growth of an *Endogen*, or inside grower. And these two names at once designate the point upon which we wish to dwell; the mode of growth of woody stems as shown by means of the microscope. These figures have been carefully drawn from photographs taken for the purpose, and are, therefore correct representations of the objects. Looking now at our cross-grain shaving of oak, we notice first, scattered somewhat unevenly all over it, large openings, which are the spiral ducts; in some parts they appear to be more closely congregated together, forming, as it were, rows which are continuous after the manner of rings, increasing in dimensions from the centre of the stick towards the circumfereace. These show us how the wood grows. At first, when it is but a sapling, there is very little woody tissue present, as is evidenced from its fragility, and the moss of it is made up of simple cellular tissue. This constitutes the pith of the stem, and varies in dimensions in different plants; in the elder being very large, in the oak of small size. Through the large spiral ducts the sap freighted with matter for the building up of new tissues, is carried upwards to the leaves;

here it is brought in contact with the sunlight and air, and certain chemical changes take place in its composition. Downwards, through another set of ducts, it is carried just inside the bark, and here through its instrumentality, woody fibre is deposited, one fibre upon the other externally, and thus the twig grows by outside growth, becoming thicker and thicker each year. This addition of substance goes on during the spring and autumn months, the plant doing very much the same as human beings, that is to say, resting during the hot season. But when winter comes its growth is arrested entirely, and like the hibernating animals the tree sleeps. Now in animals the blood is carried by a set of vessels, known as arteries, to the lungs, where it comes in contact with the air inhaled, and has its composition so changed that it can build up new tissues. The same thing, essentially, we see, takes place in the tree, the leaves representing the lungs, or oxygenating organs. Now as the tree sleeps during the winter months here is an arrest of growth, and therefore when we examine such a cross-section of a piece of wood as we have given, we find a number—less or greater, according to the number of winters it has existed—of these rings of arrested growth, and by counting them we can arrive at the age of such a stick of wood. So we see how the microscope assists in acquiring such a knowledge; and of course we shall find similar structure in all outside growers or *Exogens*. With inside growers the case is very different; for here the new matter is not deposited externally in regular rings; and, in fact we can, from a consideration of the facts we have related, readily understand why the *Endogens* are mostly confined to such portions of the globe where there are no cold months to arrest the growth. However, even in such climates, *Exogens* grow and rest also during a part of the year. We have given the two sections represented to show the very marked difference in these two modes of growth as illustrated by microscopic sections, and those who desire to verify our illustrations can readily do so

by cutting a slice of some green stem, when the sap is in the wood and it is therefore the more readily cut, and also taking a slice of some *Endogen*, the garden asparagus being an excellent plant for that purpose, and after placing them on a glass "slide" and moistening them with water, covering them with a piece of thin "covering glass," and then examining them with a microscope; even an ordinary pocket lens will often show these points of structure very well. Thus will the student of nature find instruction and amusement, knowledge and pastime, even in a shaving of wood cast off from a carpenter's jack-plane.

EXPLANATION OF PLATE 10.

Fig. 1. Section of oak wood cut transversely across the grain.
Fig. 2. Transverse section of sugar cane.
Both magnified 25 diameters.

NOTES ON SOME OF THE RARER BIRDS OF MASSACHUSETTS.

BY J. A. ALLEN.

(Continued from page 519.)

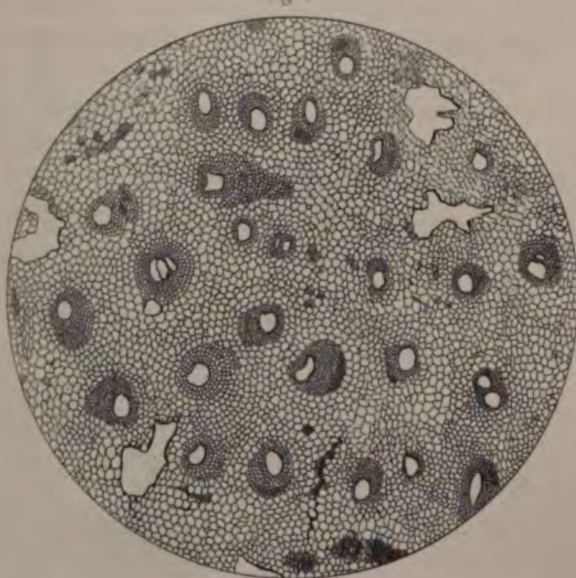
GOLDEN EAGLE. *Aquila chrysaëtos* Linn. (*A. Canadensis* auct.) A specimen was killed near Munson in November, 1864, and another near Deerfield, December 14th, 1865. The latter, a female, is said to have weighed thirteen and a half pounds, and to have measured seven feet and six inches in alar extent. It is now in the Springfield Museum of Natural History. Mr. J. G. Scott informs me that two specimens were captured near Westfield three years ago, one of which is in his cabinet.*

* In epist., Nov. 21, 1868.

Plate [illegible].

Fig. 1.

Fig. 2.



OSPREY. FISH HAWK. *Pandion haliaëtus* Sav.* (*P. Carolinensis* Bonap.) It seems at first a little strange that this noble bird should not be found breeding anywhere on the Massachusetts coast, but when we recall the peculiar situations usually chosen by it for its eyrie we cease to be surprised. At present there are here no heavy forests near the sea, with lofty dead trees spreading their broad whitened arms to receive its bulky and conspicuous nest. All who are acquainted with this bird's breeding habits must have been struck with its marked predilection for such nesting sites. While it breeds abundantly on the New Jersey coast, on portions of Long Island, on the coast of Maine and about the large lakes in the interior, it is now only seen in this state, so far as I can learn, during its migrations. It undoubtedly nested here before the thorough disforesting of the seacoast; a former nesting site near Ipswich being still remembered by some of the older residents there. The present puny second forest-growth affords it no suitable breeding places, and this is no doubt the reason of its being now but a transient visitor here.

HAWK OWL. *Surnia ulula* Bon. Mr. A. L. Babcock of Sherborn, has a specimen which he took a few years since at Natick. Dr. Brewer informs me he once obtained it near Roxbury. Mr. Scott writes that five specimens were taken at Westfield, near the village, in the autumn of 1867. In my Catalogue this species, though mentioned incidentally as probably occurring occasionally along the Green Mountain ranges in the western part of the state, was not reckoned as a Massachusetts bird. Dr. Emmons says it has been observed in that section in autumn,† and from what I now know of its distribution I doubt not it is a somewhat regular winter visitor there.

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*In the Museum of Comparative Zoölogy are numerous specimens of this bird, from Brazil, Florida, and New England, the North, and from Europe. They differ a good deal, but some of those that differ most are from the same locality. I cannot see wherein the European differ essentially from the American. Some of these are more like the American than some of the American are like each other.

† Hitchcock's Geological Report for 1835.

GREAT GRAY OWL. *Syrnium cinereum* Bon. I mentioned the capture of several specimens in this state in my Catalogue. Dr. Brewer has since informed me that about 1839 he obtained two for Mr. Audubon that were shot near Boston,—a fact which does not appear to have been previously recorded. There is also a specimen in the Museum of the Peabody Academy, taken in Salem, November 10th, 1866, by Mr. E. S. Waters.

GREAT HORNED OWL. *Bubo Virginianus* Bon. There are three specimens of this species in the Museum of Comparative Zoölogy, all from Eastern Massachusetts, that represent Mr. Cassin's three varieties *Bubo Virginianus Atlanticus*, *B. Virginianus Pacificus*, and *B. Virginianus Magellanicus*. The first of these he supposed to be restricted to the Atlantic slope of North America, the second to the Pacific slope, and the third to the extreme southern parts of this continent and to South America. Mr. Cassin remarks, "this fine species is either subject to considerable variation in the color of its plumage, or there are several species, some of which have been named by naturalists, as cited above, in our synonymes."* The first of these alternatives it seems to me is the true state of the case.

BARN OWL. *Strix pratincola* Bon. As already stated by me in the "Addenda" to Dr. Coues' "List of the Birds of New England," the first specimen of this species known to have been captured in this state was taken near Springfield, in May, 1868. Dr. Wood informs me that he has a specimen in his cabinet that was shot "at Sachem's Head [Ct.,], October 28th, 1865." The capture of another at Stratford, Connecticut, is recorded by Mr. Linsley.† These three are all thus far known to me to have been taken in New England.

YELLOW-BILLED CUCKOO. *Coccygus Americanus* Bon. No other of our birds seems to be so variable in numbers in

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* Report on N. American Birds, p. 50.

† See "Catalogue of the Birds of Connecticut," by Rev. J. H. Linsley, Am. Journ. Science and Arts, Vol. xliv (1843), p. 253.

different years as this. In my Catalogue it is mentioned as "extremely rare" at Springfield, but as occurring frequently in the eastern part of the state. Since then a number of specimens have been taken at Springfield, and others at Westfield, Chicopee and Holyoke. Dr. Wood says that it "has been very uncommon at East Windsor Hill, except in 1867, when it was as common as the Black-billed. I obtained," he adds, "three sets of eggs during that season; have seen none this year."* I think it was in 1867 that it was so unusually common at the other above-mentioned localities, but it was also taken at Springfield in 1866. Mr. Scott says he does not think it "extremely rare," as he has obtained four or five specimens without special effort. In the eastern part of the state I find it is not generally so numerous as I had supposed. It seems to be common here only at irregular intervals, when it sometimes appears to be as numerous as the Black-billed species, but sometimes it is scarcely observed for several seasons. Mr. Maynard says it was common about Newton during 1866, when the Black-billed was rare, but that it has not been so since that year, while the latter has been abundant. If the very large collections of birds from a considerable number of localities in New England in the Museum of Comparative Zoölogy can be taken as any index of their relative abundance in the Eastern States, the Black-billed species may be considered as, on the average, a hundred fold more numerous than the other.

YELLOW-BELLIED WOODPECKER. *Sphyrapicus varius* Baird. As observed by Dr. Coues,† this bird may be common in summer at many localities in New England. But in this state, so far as I can learn, it is rare at all seasons in that portion east of the Connecticut, and generally seen only in the fall. Not so, however, to the westward and northward; but I doubt its being any more numerous in Rhode

* In epist., Oct. 22, 1868.
† In List of the Birds of New England, l. c., p. 262.

Island and Eastern Connecticut than it is in Eastern Massachusetts.

Pileated Woodpecker. "Log Cock." *Hylotomus pileatus* Baird. The capture here of a bird so nearly extirpated in most parts of Massachusetts as is this, is a fact of interest. Mr. J. G. Scott informs me that he has taken three specimens near Westfield. Dr. Wood wrote me in 1864 that one was killed about five years before at East Windsor Hill, and that he had also seen it about twenty miles to the westward of this locality.

Black-backed Three-toed Woodpecker. *Picoides arcticus* Gray. Mr. Scott took two specimens, male and female, of this northern species at Westfield in 1867.

Banded Three-toed Woodpecker. *Picoides hirsutus* Gray. I learn from Mr. George O. Welch, of Lynn, that he took a pair of these birds some years since not far from that town. Dr. Brewer also gave it in his additions to the "Catalogue of the birds of the state" given by Dr. Hitchcock,* but it has not usually been numbered among the birds of the state, and doubtless occurs only as an accidental winter visitor.

Yellow-bellied Flycatcher. *Empidonax flaviventris* Baird. As remarked by Dr. Coues in his "List of the Birds of New England," this species is probably less rare than the collectors usually suppose. It seems to prefer woods and thickets, and its close resemblance to *E. minimus* when a few yards distant tends to prevent its more frequent capture. I generally meet with quite a number each year in May, sometimes several in a single excursion. Mr. Maynard informs me that he took eight specimens in a few hours May 31st, the present year. It has been observed in the breeding season as far south as Washington, D. C., by Dr. Coues.

Varied Thrush. *Turdus nævius* Gmelin. As already recorded in Dr. Coues "Addenda," this western species has at last been taken in Massachusetts, a specimen having been

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* Jour. Bost. Soc. Nat. Hist., Vol. I, p. 437.

shot near Boston (at Ipswich) in December, 1864. This seems to be the first known instance, as the specimen mentioned by Prof. Baird as having been obtained here was killed in New Jersey.*

ROBIN. *Turdus migratorius* Linn. Generally this well known bird is not met with in Massachusetts in winter except at particular localities; it seems more frequently to occur at this season in the eastern part of the state than elsewhere. It is not seen every winter, but sometimes occurs in considerable abundance. In the severe winter of 1867–'68, they were seen in Cambridge at intervals all winter; they were more numerous in January than in December, and were still more abundant in February, when they appeared in quite large flocks. They disappeared on the approach of warm weather, leaving for the north or for the interior before the arrival of their brothers from the south, which this year first appeared about March 10th. It does not seem to be an unusual mildness of the season that causes them to linger, as they are as often seen during the severer winters as in the milder.

HERMIT THRUSH. *Turdus Pallasi* Cab. Although the southern limit of this species in the breeding season is nearly coincident with the southern boundary of the Canadian fauna,† straggling pairs breed in various parts of Massachusetts. It has been taken at Springfield in June,‡ and last year I saw young just able to fly at Hyannis, July 3d. Dr. Brewer informs me he found it breeding in Roxbury, in 1837. In the more elevated western districts of the state, as in the elevated and northern parts of New England generally, it breeds regularly and in large numbers.

OLIVE-BACKED THRUSH. *Turdus Swainsonii* Cab. As is well known, this is not a rare species in this state.

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* See my "Catalogue," l. c., p. 82.

† In respect to the boundaries of the Canadian and Alleghanian Faunæ, see Prof. Verrill's remarks in the Proceedings of the Boston Society of Natural History (Vol. x, p. 260) and my own in the Memoirs of the Boston Society of Natural History, Vol. i, pt iv, p. 489.

‡ See "Addenda" to my "Catalogue," l. c., p. 97.

In my "Catalogue of Massachusetts Birds" I first advanced the opinion that the so-called *Turdus* "*Aliciæ*" Baird, or Gray-cheeked Thrush, was but the paler form of this species. To this view other writers have taken exceptions. Prof. Baird, in his "Review of American Birds" (p. 21), summarily disposes of the matter by presuming that I had not seen what *he* called *T. Aliciæ*. Dr. Coues, in his "List of the Birds of New England," in referring to my remarks on the subject, says they "illustrate very fully the well-known seasonal and other variations to which *T. Swainsonii* and *T. fuscescens* are subject," and adds that I appear to have been "autoptically unacquainted" with *T. Aliciæ* at the time of writing them. Since that time I have still farther considered the subject, and have had large series of authentic specimens of both *T. Swainsonii* and *Aliciæ* (mostly so labelled at the Smithsonian Institution) for comparison with Massachusetts specimens, and after five years of additional experience I am now more than ever convinced that the opinion there expressed is correct. Some years the *Aliciæ* type is quite common; again more rare. Generally, however, the majority of the specimens range between the forms considered as typical respectively of *T. Swainsonii* and *T. Aliciæ*.*

Mocking Bird. *Mimus polyglottus* Boie. Several instances of the occurrence of this southern species in the vicinity of Springfield other than those previously recorded have come to my knowledge during the last five years, and also one of its occurrence in the eastern part of the state.

Connecticut Warbler. *Oporornis agilis* Baird. Concerning this species Mr. C. J. Maynard writes: "Perhaps not as rare as is generally supposed by collectors, especially in autumn. A specimen was shot by Mr. L. L. Thaxter in Newton Centre, September 16th, 1867. Another was taken by myself in September, 1868, in a thick swamp near Newton."†

* For a fuller discussion of this subject, see my paper in the Memoirs of the Boston Society of Natural History, Vol. i, part iv (1868), p. 507.

† MSS. notes, received June, 1869.

Tennessee Warbler. *Helminthophaga peregrina* Cab. This species, generally rare here, appears to have been much less so this year than usually. Mr. Maynard took five at Newtonville during May 18th to the 23d,—the first, he says, he had seen. He informs me that his friend Mr. William Brewster procured at about the same time two near Mount Auburn. I have taken it repeatedly at Springfield, where I have always esteemed it rare; but Mr. Boardman says he finds it quite common near Calais, Maine.*

Golden-winged Warbler. *Helminthophaga chrysoptera* Baird. This beautiful warbler has been taken, so far as I can learn, but a few times in the western part of the state; it seems to be more common in the eastern, where it breeds. I saw it once in July at Springfield, and Mr. S. Jillson informed me some years since that it was quite frequent at Bolton, where it spends the summer and undoubtedly breeds. I am not aware that its nest has been found in the state prior to the present year, when it was discovered by Mr. C. J. Maynard, June 12th, near Newtonville. This gentleman says that for the last three years he has seen this Warbler in swampy thickets near Newton in June, and felt confident that it bred there. This year he observed a female so anxiously chirping from a small elm that he felt sure she had a nest in the vicinity, and quietly watching her he soon saw her fly down into the weeds. Approaching the spot carefully he discovered her sitting on her nest. This he describes as situated on the ground, in a tract of coarse weeds and ferns near a swampy thicket, and but a few rods from a public highway. It was placed entirely above the surface of the ground, and the birds seemed to have made no special effort to conceal it. It was composed externally of dried oak leaves and the bark of the grape-vine, and rather roughly lined with fine grass and a few horse hairs. He says it is large for the size of the bird, and somewhat reminds one

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* See American Naturalist, Vol. iii, June, 1869, p. 122.

of the nest of the Maryland Yellow-throat. It is a little smaller at the top, where the internal diameter is less than two inches, while in the middle it is two and a quarter. The eggs were five in number, including a Cow Bunting's egg that these watchful parasites had introduced. The Warbler's eggs are thus described by Mr. Maynard:

"No. 1 is regular in form, thickly spotted and blotched with dark brown at the larger end and sparsely at the smaller, on a white ground. Length, sixty-six one-hundredths of an inch; diameter, fifty-five one-hundredths. No. 2 is like No. 1, only it is less thickly spotted. Length, sixty-six one hundredths; diameter, fifty-three. No. 3 is least spotted of the four, it being but sparsely so on the larger end and not at all on the smaller. Dimensions same as those of No. 1. No. 4 is more elongated, and much the most spotted, the spots forming a broad band around the larger end, and are scattered over the remaining surface."

Mr. Maynard adds: "It is a curious fact that although I have seen and collected quite a number of males of this species, this is the first female that I have seen, although I have made diligent search for them."

SWAINSON'S WARBLER. *Helmitherus Swainsonii* Bon. Although this species is recorded by both Audubon and Peabody as having been taken in Massachusetts, and on these authorities given in my Catalogue, there is some reason to doubt its having been captured here. Both notices doubtless refer to the same specimen, as well as to the same authority,—Dr. Brewer. But this gentleman informs me that the record is erroneous and the result of a misunderstanding; the specimen referred to he says was not this species at all. Dr. Brewer knows of no instance of its occurrence here, and it should doubtless be stricken from the list of Massachusetts birds. Dr. Coues says he has never seen it so far north as Washington, D. C.*

WORM-EATING WARBLER. *Helmitherus vermivorus* Bon. Mr. Peabody states, in his "Report on the Birds of Massachusetts," that the nest of this species had been found in Cambridge, which statement I repeated in my Catalogue.

*List of Birds of New England. Proc. Essex Inst., Vol, v, p. 270.

I have since been informed by Dr. Brewer that the nest referred to by Mr. Peabody as above "was, without doubt, a Nashville Warbler's. I do not think it occurs," he adds, "nearer than the Hudson River."* Prof. Verrill, however, in his list of the birds of Norway, Maine (p. 21), gives it as rare in the southern part of Maine. From its range being generally southern, its occurrence in New England can only be accidental.

SMALL-HEADED FLYCATCHER. *Wilsonia minuta* Bon. This rather apocryphal species is given by Peabody as having been met with at Ipswich by Dr. Brewer, and in Berkshire County by Dr. Emmons (Rep. Orn. Mass. p. 297). Dr. Brewer writes me that in 1834 his cat caught a specimen of this species in Roxbury, which he sent to Audubon, though as Dr. Brewer observes, he (Audubon) makes no mention of it. Dr. Brewer remarks: "This was the only one I ever knew or heard of. Ipswich I *ignore*." Compare with this Dr. Coues' remarks on this supposed species in his "List of the Birds of New England."†

LONG-BILLED WATER THRUSH. *Seiurus Ludovicianus* Bon. The first and only specimen thus far known to have been found in Massachusetts I captured April 28th, the present year, on Mount Tom. There is another in the Museum of Comparative Zoölogy, taken by Irving Frost, at Norway, Maine, in May, 1865. These two I believe are all the specimens known from New England, its actual occurrence in the Eastern States being now for the first time reported.‡

BLACKBURNIAN WARBLER. *Dendrœca Blackburniæ* Baird. Mr. Bennett found the young of this species this year near Holyoke that were scarcely able to fly. This establishes its breeding in Massachusetts. This fact I had already inferred, as in 1863 I shot it in Springfield, June 24th. Mr. J. G. Scott also shot it in Westfield, late in June, 1866. Some

* In epist., May 8, 1869.
† Proc. Essex Inst., Vol. v, p. 275.
‡ See concerning this species Dr. Coues' List of New England Birds, l. c. p. 271.

seasons they are extremely abundant at some localities, and commonly are not rare, except in particular situations. Mr. Scott observes that for several weeks in May, in 1866, he could remain at a single place in the woods and shoot ten to twenty per hour.

Bay-breasted Warbler. *Dendrœca castanea* Baird. This species I find is esteemed to be rare by most collectors in the eastern part of the state, but in the Connecticut valley it is generally more or less common and sometimes very abundant. I found it very numerous in 1866 in Springfield, and it seems to have been equally so the same year in Westfield. Mr. Scott writes, "I could easily have shot a bushel-basket full of them without very greatly changing my position." He says it was scarce in 1867, but not very rare in 1868. In 1866 he obtained a partial albino. Mr. Maynard, however, considers it to be very rare about Newtonville. He has known only a few specimens taken there, as follows: June 19th, 1867, May 22d, 1868, and May 27th, 1869.

Prairie Warbler. *Dendrœca discolor* Baird. In particular situations a more or less common summer resident. In the eastern part of the state, especially in the breeding season, it is much more common than in the western. Old pastures partially grown up to cedars and barberry bushes seem to form its favorite resorts.

Cape May Warbler. *Perissoglossa tigrina* Baird. This species, like most of the warblers, varies greatly in abundance in different years and at different places. Generally it seems to be very properly regarded as rather rare. Specimens, however, are taken almost every year in different parts of the state, but generally they altogether number very few. Mr. Maynard tells me it has been found near Boston, by Dr. Bryant and others, to be some years quite common.

Summer Red Bird. *Pyranga æstiva* Vieill. Mr. A. L. Babcock, of Sherborn, has a specimen taken in Framingham

some years since in May. This, I believe, forms the second authentic instance of its capture in this state. Two were taken in Lynn, April 21st, 1852, by Mr. S. Jillson.*

NORTHERN WAX-WING. *Ampelis garrulus* Linn. The visits of this beautiful northern species so far south are very infrequent, and in only a few instances has it been recorded from this state. It has been taken, however, in Connecticut by Dr. Wood. I am also informed by Mr. S. Jillson, that eleven specimens were taken by him in Bolton, in this state, in January, 1864. A specimen has been seen the present autumn (October, 1869), in Cambridge, by Wm. Brewster.

SOLITARY VIREO. *Lanivireo solitarius* Bon. This species formerly supposed to be more properly a spring and autumn visitant than a summer resident, seems to breed not unfrequently at some localities. Dr. Brewer says it is as common in summer about Roxbury as any of the Vireos, except perhaps the Red-eyed.

WHITE-EYED VIREO. *Vireo Novæboracensis* Bon. As stated in my Catalogue, this species is much more common in the eastern part of the state than in the western. Like some other species, it is much more common during some years than in others. Dr. Wood has found three nests at East Windsor Hill during the last ten years, but he considers it rare there. Mr. C. W. Bennett obtained the first specimen I have known found in Western Massachusetts in May, 1867, at Holyoke. I killed a pair the last week in July in Springfield, in 1868. These I believe are the only ones as yet known from that portion of the state. In 1868 it was quite common in and about Cambridge, but this year I have not observed it.

LOGGERHEAD SHRIKE. *Collurio Ludovicianus* Baird. (*Lanius excubitoroides* and *L. elegans* Swain). This species, as observed by Dr. Coues,† was formerly given as a bird of New England, but deeming the authority to be highly ques-

* F. W. Putnam, Proc. Essex Inst., Vol. 1, p. 224.
† List of the Birds of New England, l. c. p. 277.

tionable, I omitted it from my Catalogue. As Dr. Coues remarks, New England is beyond its usual range; the nearest point heretofore given where it regularly occurs is Hamilton, C. W., where, according to Mr. Charles McIlwraith, it is not a very rare summer resident.* Mr. Charles Linclen informs me that he has this year obtained the birds and a nest containing six eggs at Buffalo, N. Y. Its occasional occurrence in New England hence becomes more probable.

On several occasions the so-called *Collurio excubitoroides* has been confounded by local observers with the *Collurio Ludovicianus*, and with very good reason, since they are undoubtedly the same. Specimens from the upper Mississippi valley, where the habitats of the two supposed species join, are with difficulty referred to the one rather than to the other. In habits and every particular, except in some minor differences of coloration, the two are quite alike. In fact no one seems to have insisted very strenuously on the specific distinctness of *C. Ludovicianus* and *C. excubitoroides* (or of *C. elegans* from the latter) though they have usually been presumed to be distinct. I have collected the birds in question in Western Iowa, Illinois, and in Florida; according to authors those from the first two localities should belong to *C. excubitoroides* and those from the latter to *C. Ludovicianus*. The differences between them are exceedingly slight. Specimens of the so-called *C. Ludovicianus* from the South Atlantic states differ from others from California and Iowa called *C. excubitoroides* not more than specimens of the latter from New Mexico do from Iowa ones, or than the two supposed species do in the average, and less than specimens from near the assumed line of junction of their respective habitats. Audubon, it seems to me, very properly regarded them as a single species. It seems to be rare in the Atlantic states north of Washington, but in the interior reaches the Saskatchewan valley, and extends westward to the Pacific, and south to Mexico. In avoiding the

* Birds of Hamilton, C. W., Proc. Essex Inst., Vol. v, p. 87.

North-eastern states it resembles the *Eremophila alpestris*, or Horned Lark (in the breeding season), *Myiarchus crinitus* (Great-crested Flycatcher), *Centurus Carolinus* (Red-bellied Woodpecker), *Melospiza Lincolnii* (Lincoln's Sparrow), *Zonotrichia leucophrys* (White-crowned Sparrow), and some other species that extend much farther north in the interior than on the Atlantic coast. The Horned Lark is not known to breed regularly on the coast much, if any, south of Labrador, but in the interior it breeds abundantly on the prairies as far south as Missouri, and even in Texas. Some of the other species mentioned above do not extend farther north on the coast than New Jersey, except as stragglers, although in the interior they reach the Saskatchewan. The climate there is certainly not warmer than that of Southern New England, and some other cause must be sought to explain such an unusual distribution.

RED-BELLIED NUTHATCH. *Sitta Canadensis* Linn. The known instances of this bird's breeding in Massachusetts are very few. Five years since, when my Catalogue was published, I knew of none, and gave it as a winter visitant, having then seen it only during the colder portion of the year. Mr. Jillson has informed me that he found its nest a few years since in Bolton. Dr. Brewer also informs me that he saw it on his place in Hingham, in July, 1867, but was unable to find its nest. Many experienced collectors of birds in Southern New England have never met with it here in summer, but it is known to breed (perhaps only among the Alleghanies) much farther south.

PINE GROSBEAK. *Pinicola eneucleator*. (*P. Canadensis* Cab.). This northern bird has occurred within the state several times within the last five years. During the last two winters they were quite common at certain localities, but were not generally distributed. As usual, they were chiefly young birds. It seems to be of late a more regular visitor than was formerly supposed.

PURPLE FINCH. *Carpodacus purpureus* Gray. Common

in summer in many parts of the state, and the number that breed here seems to be increasing. They usually select evergreens for their nests, and appear to more often build in the cultivated shrubbery of the towns than elsewhere. They are almost as unsuspicious as the proverbially familiar Chipping Sparrow (*Spizella socialis*), they often placing their nests in the hedge-rows that border frequented walks. I learn from Mr. B. P. Mann that he has repeatedly found their nests in such situations, and Mr. R. B. Hildreth has observed the same fact at Springfield. This familiar habit in the Purple Finch of California has obtained for it the name of House Finch, and it was supposed to differ greatly in this respect from the Purple Finch of the Atlantic states, before the breeding habits of the latter were so well known. It differs in this respect not apparently from the eastern bird, nor in any other way to any essential degree, specimens from California in the Museum of Comparative Zoölogy being quite indistinguishable from others from Massachusetts. Hence its distinctive name of *frontalis* becomes properly a synonym of *purpureus*.

For the past two winters I have observed individuals of this species at frequent intervals in Cambridge, and Mr. Bennett has observed it at the same season about Mount Holyoke. By far the greater part, however, go farther south at this season.

Nearly all observers in Southern New England that I have met remark that this bird has greatly increased there during the last ten years; especially is it more numerous in the breeding season.

PINE FINCH. *Chrysomitris pinus* Bon. But a single instance of the breeding of this bird in Massachusetts has come to my knowledge—that mentioned in my Catalogue. The present year, however, they were quite common in Cambridge till the last of June, and on two or three occasions I observed them during the first half of July. I felt sure at one time that they would breed here, but if they, like the

Yellow Bird (*Astragalinus tristis*), breed very late in the season, they may have retired in July farther north for this purpose, as I did not meet with them later in the season. This is very probably the fact, since Mr. William Brewster found this species breeding in August this year at Gorham, New Hampshire.

RED-POLL FINCH. *Ægiothus linaria* Cab. During the past five years this little northern visitor has been several times very numerous in Massachusetts. It was especially so during the winters of 1866–'67, 1867–'68, and quite so in 1868–'69.

A series of skins in the collection of the Museum of Comparative Zoölogy, collected in this state by Mr. C. J. Maynard, represent four of the so-called species of this group recently recognized,—the common *Æ. linaria*, the supposed larger Mealy Redpoll, *Æ. canescens* Aud.,=*Æ. epilipes* Coues, the *Æ. rostratus*, and the *Æ. fuscescens*, described as a new species by Dr. Coues.* From a careful examination of many specimens, from the far north, as well as from Massachusetts, I cannot consider these forms as distinct species, since the differences on which they are based are very inconstant, and connected by endless intermediate stages. The extreme forms to which these several specific designations have been applied are quite different from each other, and if the differences were constant might well be regarded as distinct species. But, as already stated, the differences are not constant, and it is almost impossible to draw a separating line between these several so-called species.†

RED CROSSBILL. *Curvirostra Americana* Wilson. This bird, as is well known, is very irregular in its visits to this state, not only in respect to numbers but in regard to the season of its appearance. It is generally most numerous in winter, but is sometimes more or less common throughout

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* See his "Monograph of the Genus *Ægiothus*," Proc. Phil. Acad. Nat. Sci., Nov., 1865.

† On this point see farther my "Notes on the Birds of Iowa, Illinois, etc.," in the Memoirs of the Boston Society of Natural History, Vol. i, pt. iv, p. 515 (foot note).

the year; at other times very few are seen for a considerable period. Concerning this species I have received from Mr. Maynard the following very interesting note. He says that in 1868 these birds appeared in Massachusetts "early in September, in very immature plumage, which seemed to indicate," he thought, "that they were raised in the states. But upon visiting Oxford county, Maine," he continues, "October 12th, and not seeing a single specimen of this bird (although after the 21st the White-winged species was common) I was induced to inquire of the farmers respecting them, when I was informed that they passed through that region early in August, in large numbers, doing great damage to the oat crop. This shows that the unusual occurrence of this bird in immature plumage early in the season was owing to the early migration of northern raised birds, induced, probably, by an insufficient supply of food, which I think regulates the migrations of *all* northern birds; hence the irregularity of their visits. The species in question passed entirely south of Newton (Mass.), as upon my return from Maine, November 13th, not a specimen could be found, but *C. leucoptera* was abundant. From what I have seen of these two species I think the latter is generally much more boreal in its habits."*

Specimens of the Red Crossbill have been received at the Museum of Comparative Zoölogy from Massachusetts so young that it seems highly probable that they were raised here. Among them are specimens collected in Weston, in May, 1862, by the late Mr. Horace Mann. Some were so young that their bills were not fully grown, while the plumage also indicated great immaturity. It is hardly possible that they could have been born far from where they were collected. The condition of the specimens collected by Mr. Maynard, alluded to above, seems to indicate that they also have not been long from the nest, though they may, as he supposes, have come from Maine. These facts seem to

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* MSS. Notes, received in July, 1869.

indicate that this species breeds at irregular times, since the eggs obtained near Milltown, Maine, by Mr. G. A. Boardman,* were, as he has informed me, found in February, and birds hatched thus early would probably moult their nesting plumage early in summer. Mr. Maynard's specimens must have been hatched at least as late as June, and probably in July, else in respect to the time of moulting the first or nestling plumage of this species is strangely anomalous.†

Since the above was put in type I have received from Mr. Boardman farther information respecting the breeding of the Crossbills, as follows: "They breed all the season, from the middle of February till into May, and perhaps later."

WHITE-WINGED CROSSBILL. *Curvirostra leucoptera* Wilson. This species is much less frequent in its visits than the preceding, it being, as Mr. Maynard has observed, much more boreal, and is generally seen only in winter. Last winter they were quite numerous in the eastern part of the state, when, as he has stated above, Mr. Maynard observed them as early as the middle of November. They remained, according to the same authority, till the first of June, they being observed by him in flocks during the last week of May. He also informs me that he shot a male in fine breeding plumage the 13th of June. In the summer of 1866 he found their stomachs filled with canker worms.

LAPLAND LONGSPUR. *Centrophanes Lapponicus* Kaup. This is a very rare winter visitor in the interior of the state, but rather common, according to Mr. Maynard, at Ipswich, where he has taken half a dozen in a day, and seen many more. It associates with the Snow Bunting (*Plectrophanes nivalis*), and is probably more or less common in winter along the whole coast of the state.

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* See American Naturalist, Vol. iii, July, 1869.

† With the above Mr. Boardman sends the following interesting notes: "The Canada Jay also breeds when the snow is quite deep, usually in March, and I think again in summer, as I have seen young birds in September. I have also found Raven's eggs when the snow was quite deep, and have also known the young of *Mergus Americanus* to be out by the middle of May, which is usually early."

THE LINGERING ADMIRERS OF PHRENOLOGY.

BY PROF. CLELAND.

To slay those that are already slain may be excellent sport to employ the courage of a Falstaff, but the reader perusing the title of this article may perhaps be disposed to ask why the pages of this review should be occupied with the discussion of so dead a doctrine as Phrenology. The answer is, that although phrenology never had much countenance from scientific men, and has long since been banished by them, with one consent, to the limbo of exploded chimeras, yet among educated men and women not physiologists, and not pretending to know anything about anatomy, it still holds its grounds wonderfully, and counts considerable numbers of people who believe in its miraculous skull maps; while, besides these, there is a far more numerous class of persons, including, undeniably, a certain proportion of scientific men, who, admitting that the minute division of the cranial vault into organs is untenable, yet profess belief in a larger mapping, and have no hesitation in relegating the reasoning faculties exclusively to the forehead, and the moral sentiments and volitionary powers to other parts of the brain-pan.

This state of matter does not exist without a sufficient reason to account for it. Long before the time of Gall and Spurzheim, men were in the habit, sometimes consciously, and much more frequently half unconsciously, of gauging the intelligence and moral qualities of their neighbors by their personal appearance generally, and more particularly of estimating them according to crude impressions derived from the shapes of their heads. They judged rightly enough that there was some connection between brain and mind. Much of the evidence that the brain is the organ of the mind is so palpable that it could not remain long hid. The effects

of injuries and diseases of the brain in disturbing the intelligence, its larger size in the higher than in the lower classes of animals, and more especially its distinctively great development in man: these circumstances, together with the indubitable frequency of finely proportioned heads among persons of distinguished talent, and the tendency of the eye to dwell on clumsy or forbidding proportions, when occurring in persons brought under notice as stupid and depraved, all seemed, though vaguely, to point out that a scrutiny of the amount of the brain and shape of the cranium was likely to afford an index of the strength and qualities of the mind. Gall propounded his theory that different portions of the brain were the organs of different mental faculties, and that according to the size of those different parts of the brain, so the mental qualities varied; and making continual observations on the heads and characters of those with whom he came in contact, he covered the surface of the cranial vault with a map, which at once professed to indicate the correct analysis of the mental faculties, and to assign to each of these its proper habitation. The psychological difficulties of their pursuit do not seem to have weighed heavily on either Gall or his followers; and as for the exceedingly great obstacles in the way of estimating the proportions of even large masses of the brain by observation of the surface of the skull, not only did the phrenologists strangely ignore them, but we are constrained to say that even anatomists have been very slow to appreciate them. Phrenology, however, supplied a want which the public felt, seeming to furnish an answer to questions which were continually obtruded before them, and giving precision to the notions founded on fact which had previously possessed their minds: this, we believe, is the principal reason why phrenology became so popular as it did, and why it is not yet eradicated from the public mind.

Probably scientific men, in dealing with phrenology, have been too much in the habit of contenting themselves with

merely pointing out that the system is certainly a blunder; and their hearers have gone away impressed with the conviction that it is impossible for the uninitiated to argue with experts, yet saying in their hearts that they are sure there is a mistake somewhere, and unwilling to part with all their beautiful theories and get nothing in exchange. Iconoclasm is not popular: when an image is thrown down it is well that its destruction should make way for a flood of light sufficient to satisfy the eye in its stead. This is an achievement not easy to accomplish, but actuated with the laudable motive of attempting it, the writer will try, not only to reiterate the reasons why phrenology cannot possibly be true, but to give some idea of what is positively known regarding the brain and its functions, and to point out in what direction speculation may be still legitimately indulged.

Let us begin at the beginning and try and form some general notion of what the brain is as it is known to the anatomist, before we dogmatize about the functions of the parts which happen to come in contact with the upper and lateral walls of the skull.

If a chick be examined in a hen's egg which has been allowed to hatch for twelve hours, or if the embryo of any vertebrate animal be examined at a similarly early period, it will be seen to exhibit a long open furrow, the walls of which are the first portions of the animal to be formed. The most superficial layer of substance entering into the construction of this furrow may be described as a long ribbon, consisting of two symmetrical parts separated by a longitudinal groove: this is the embryo brain and spinal chord, constituting one continuous structure, the cerebrospinal axis. The parts which support the ribbon form in like manner the cranium and the spinal canal, primarily undistinguishable one from the other. The edges of the furrow rise up and become united, so that the open furrow is converted into a closed cylinder; and similarly the ribbon within it has its lateral edges brought together, so that the brain and spinal cord

at an early period of their development, form one continuous tube. The walls of the tube so formed become ultimately much thickened and exhibit two kinds of texture, which, from their color, are distinguished as the gray and the white. In the case of so much of the tube as lies in the spinal canal and is afterwards termed spinal cord, the development proceeds very regularly; white matter is deposited on the outer wall of the cylinder, and gray matter on the inner wall, until it appears solid. A minute canal, however, the central canal of the spinal cord, continues to traverse its whole extent throughout life, and is the remains of the original hollow of the tube. Towards the lower part of the cord in birds there is even a space called the sinus rhomboidalis, where the cylinder is never completed, and the central canal is open on the dorsal aspect. Now, however different the brain may be in the adult condition from the spinal cord, it is extremely interesting to note that it is the anterior portion of the same cylinder, but that the cylinder undergoes some bendings, its walls are greatly thickened in some places and imperfect in others, and the continuation of the central canal is in some places greatly dilated, and in others contracted.

As respects texture, there is much in common between the brain and spinal cord. They are similar in appearance, and both consist of true nerve tissues, with a fine reticulum of supporting substance in which those more important elements are embedded. The proper nerve tissues are two in number, nerve fibres and nerve corpuscles: the nerve fibres are long threads which have the property of transmitting along their course a certain change of condition which constitutes nervous influence, and which, it may be mentioned, is a purely physical action, not electrical, but involving in its operation electrical changes. Nerve fibres transmit this influence, but have no power of originating, directing, or modifying it: they are simply conductors, and such nerve fibres are the essential elements in all the nerves throughout

the body. Nerve corpuscles are bodies of which it is only necessary to say that they present a variable number of poles or branches, and there is no reasonable doubt that these poles are in direct continuity with nerve fibres. According to circumstances little understood, these corpuscles have the property of modifying impressions or nervous influence, and of directing them into different channels with which their poles communicate. Now the white substance of the brain and spinal cord contains only nerve fibres without any nerve corpuscles, these latter being found exclusively in the gray substance. It is quite plain, therefore, and universally recognized, that the white substance is only useful as containing channels of communication between different parts of the gray, and also between the gray substance and the muscles and sensitive parts throughout the body. But even the gray substance is not always or even generally capable of being affected directly by the consciousness; and in the case of the spinal cord, it is very certain that consciousness resides in no part of it, either white or gray. The spinal cord is the centre with which are connected the nerves of the muscles and integuments of the greater part of the body, and in the ordinary actions of the body what usually happens is this, that impressions made by the contact of external objects on the terminations of sensory nerves in the integument are transmitted by them to the nerve corpuscles of the cord, and, through series of these, conducted to the parts of the brain, which are in immediate connection with consciousness; while also, when the mind wills certain movements of the body, the stimulus proceeds from those parts of the brain, and, by some altogether unknown mechanism, is ultimately so distributed that there extend from the gray matter of the cord impressions along the nerves so adjusted as to produce precisely that amount of contraction of muscles, of whose existence the mind is utterly ignorant, which is necessary to effect the required result. But it is always the same kind of stimulus, the nervous influence, wherever

it issues from, which acts upon the cord. Thus, for example, when the cord near its upper part is severed from the brain by an injury, there is loss of all sensation and voluntary motion in the parts supplied by it below the place of lesion, the consciousness being no longer in communication with those parts; but irritation of the integument still sends a current as before to the spinal cord, and this being distributed by the corpuscles of the gray matter, and descending again by the motor nerves, causes involuntary contraction of muscles. This is probably the simplest possible example of the phenomenon termed by physiologists reflex nervous action.

We have ventured on this extremely cursory and general survey of the spinal cord, the simplest portion of the cerebrospinal axis, in order that the general reader may form some conception of the kind of mechanism which extends through the more obscure and intricate portion, the brain. To explain fully the extremely complex structure of the brain would require much greater detail than is allowable in an article like this, but a general idea of the most important facts will best be arrived at by pursuing the account of its early development, which we have already begun.

The cylinder which we have traced in the embryo, so far as the spinal cord is concerned, is immediately on its closure, expanded in its cranial part into a series of three primordial vesicles, and immediately afterwards two little hollow buds, called the hemisphere vesicles, project laterally from the foremost of the series. Without tracing the history of the primordial vesicles, it is sufficient for our present purpose to point out that the cerebellum is originally a part of the hindermost, projecting upwards as a hollow pouch, and that it is quite certain, from the experiments on lower animals, that no consciousness whatever resides in any of the parts developed from that vesicle; also it is equally certain that not more than the very feeblest consciousness resides in those parts into which the walls of the two other primordial vesi-

cles are developed. These parts are devoted to the carrying on of obscure functions connected with the sensibility and movements of the body strictly comparable with the functions of the spinal cord, and entirely of a physical description: the organs of the mental faculties are the developed hemisphere vesicles, and these only. The hemisphere vesicles rapidly enlarge and extend backwards over and around the other parts of the brain, so as to reach to the cerebellum behind, come in contact with the whole roof and sides of the skull and a large part of its floor, and press one against the other in the middle line of the whole length of the skull for an average depth of a couple of inches; and early in embryonic life they are already much the most bulky parts of the brain.

The gray matter which lines the whole length of the cerebrospinal cylinder fails to be developed in the hemisphere vesicles, except at one part placed at the neck of the vesicle, and called by anatomists the corpus striatum, but of which we know nothing in respect of function, and can only note that it is traversed by the whole mass of fibres joining the hemisphere vesicles with the cord and cerebellum. The whole of the rest of the hemisphere vesicle, or, as it is termed, the cerebral hemisphere, consists of an enormous mass of white matter, with a superadded layer of gray matter on the outside. The cerebellum has the same peculiarity of having its gray matter on the surface, and it is curious to note that both the gray matter on the cerebellum and that on the cerebrum, while differing one from the other in minute structure, differ still more from the gray matter which is found elsewhere, and the function of which is, as we have seen, in a general way, well understood. Also the cerebellum and cerebral hemispheres resemble each other in being thrown into numerous elevations and depressions, in order to expose a larger extent to the vascular membrane on their surface, which sends its minute branches into them. These circumstances might plead a little for the doctrine that

the cerebellum is connecting with a psychical faculty, whatever that might be, but its totally different source of origin is clearly opposed to such a notion; and we are not left merely to speculate on the subject, for both disease in the human subject, and experiment on animals, teach us that when the cerebellum is destroyed, the power of combining movements so as to regulate and guide them is lost, the limbs being still capable of being moved, but walking and handling being impossible. Thus it is certain that the function of the cerebellum is totally different from what the phrenologists hold it to be.

Examining the cerebral hemispheres in different animals, and proceeding from the lower to the higher forms, a progress in development is found, similar to the progress made in embryonic life. Thus in fishes they are represented by very small parts in the fore part of the brain; in birds they have not extended sufficiently backwards to be in contact with the cerebellum, and their bulk is due almost entirely to the corpora striata; in rodent animals their surface is smooth; and, as one passes to the higher groups of mammals, more and more complicated convolutions of the surface are met with; while in man by far the greatest complexity is found.

Whatever the particular cerebral changes may be which accompany and are necessary for thought, there can be no question that they occur in the gray matter, and that the white matter is only useful by bringing the different parts of the gray matter into communication one with another, an end which it accomplishes very thoroughly by its complicated commissures and countless bundles of fibres taking all directions. Judging, then, from comparative anatomy, and even on phrenological principles, one would expect that, among men, the greater the amount of gray matter of a given quality the more effective would the hemisphere be for the exercise of the mental faculties; and this, there is good reason to consider, is to some extent actually the case. But

the quantity of gray matter varies according to other circumstances besides the size of the skull. The vertical depth at any one spot, from the surface of the gray matter down to the white, differs in different brains; and what is probably more important is, that the complication of the convolutions varies greatly. Complex convolutions are probably more important than the thickness of the sheet of gray matter, because it is obvious that not only quantity but activity of texture will be an advantage; and complexity of convolutions involves increased surface of vascular membrane, sending its blood-vessels into the gray matter, and furnishing its elements with the means of activity. In harmony with this supposition, the simplest condition of the convolutions has been found in the brains of the lowest races of humanity, and Wagner's comparisons of the brains of various persons of ability with others from persons of supposed limited intelligence show more complicated convolutions in the former than the latter, although at the same time exhibiting apparent exceptions to that rule. It may be noticed in this connection that if two skulls of the same cranial capacity be one long and narrow and the other short and broad, the long and narrow one is that which has the greatest amount of surface, and is therefore most favorable for a large proportion of gray matter; so that, *ceteris paribus*, the long skull has probably an advantage over the broad skull; while, on the other hand, there is no doubt that, with a given model of skull to start from, the tendency of expanding hemispheres is rather to increase the breadth than the length.

Turning now to the fundamental doctrine of phrenology, that different parts of the cerebral hemisphere are the organs of different mental faculties, we feel assured that no physiologist will hesitate in giving it a distinct and emphatic denial. It is true that the convolutions of the hemispheres are so constant that they are named; but the existence of the convolutions is not for the sake of dividing the hemispheres into parts, and does not do so, but only affords, as

has been said, facility for vascular supply; and, at all events, the convolutions have not the smallest correspondence with the phrenological organs which cross them, cut them up, and combine them in the most regardless fashion.

But the fatal objection to the doctrine of different functions in different parts is to be found in the teachings of experiment and pathology. An animal will bear to have its cerebral hemispheres gradually sliced away; and the slicing may be done in any direction with the same result, namely, gradually increasing stupidity, but with no change of character according as one or other phrenological organ is removed.

So also, persons have often recovered from wounds from which portions of the brain have protruded and been amputated, but it makes no difference what part of the hemisphere is injured; nor, in cases of tumors destroying portions of the hemispheres, is it at all possible to state the position of the tumors from any alteration in the mental constitution of the patient. The symptoms are perfectly irrespective of the part of the hemisphere affected.

Not only, however, are the hemispheres not divided into organs, but, supposing that such organs existed, it would be impossible to tell their size by the phrenological method. The bulging of any portion of the cranium vault does not indicate an increased thickness of the gray matter at that part, or give any clue to the degree of development of the convolutions opposite to the spot. Indeed, the shapes of skulls indicate differences of form in the central white matter of the hemispheres, rather than local differences of development of the gray matter on the surface. The sheet of gray matter is disposed with tolerably even thickness over great tracts, and always reaches its greatest complication of structure in the same region—namely, towards the back part.

It is not necessary to dwell at length on what has been discussed, *ad nauseam*, long years ago,—how one-half of the

surface of the hemisphere, namely, the part looking to the middle line and to the base, is beyond the reach of all phrenological observation; and how the most minute organs have been crowded by phrenologists over a part of the skull whose configuration is certainly not in the slightest degree affected by the form of the brain, namely, the line of bone immediately over the nose and eyes. But the accompanying figure speaks for itself. It has been obtained by tracing from a horizontal section of a skull, made half an inch above the orbit, dividing the phrenological organs of individuality, size, weight, color, and order, as indicated by Spurzheim, and passing quite above three still more nonsensical organs, viz., that of form, lying on the nasal cavity; calculation, which is never anything but the solid external orbital process of bone; and language, the so-called large size of which is an appearance of the eye dependent on want of projection forwards of the face bone on which it rests.

Turning now to the less special but more generally diffused notions respecting localization of different faculties in different parts of the skull, a few words may be said about fine foreheads. It may be freely granted that a handsome forehead is a beautiful feature, and one frequently, though by no means always or exclusively, met with in persons of talent; but a spacious and well-shaped forehead by no means necessarily indicates preponderance of the frontal lobes of the hemispheres over the others. This, with some other interesting points, will best appear by considering the general shape and mode of growth of the cranium. The cranial cavity, as has been already said, is originally the upper part of a long cylinder, the remainder of which becomes the spinal canal; and it may be regarded, even in its adult state, as a cylinder much modified and distorted. At an early embryonic period it is in all animals curved remarkably downwards on itself. Examining it, however, in adults, the total curvation of the cranial cylinder is seen to differ much in different species, becoming greater the higher the position

of the animal. This increasing curvature is accompanied with increasing expansion of the roof bones of the skull and arrest of the basal bones: thus in the human subject the roof bones are expanded far more than in any other animal, while the basal bones are crowded and even fused together by their position in the concavity of the curve of the cylinder. The human curve is not complete in infancy; for, as the present writer has elsewhere shown, it goes on increasing for several years after birth: it is also greater in the higher than in the lower races of mankind. This curvature is an important means of increasing the space for the cerebral hemispheres, by lengthening the roof; and it does so most effectually when accompanied with the other means which Nature uses to expand the cranium, namely, increase of vertical and transverse diameter of the cylinder.

Farther, before returning to the question of foreheads, it must be pointed out that the position in which the head is articulated with the neck differs in different persons, according to the weight of the fore and back parts, so as to preserve balance. This is best seen in the process of growth, for the forehead and face have the smallest proportional development in young children; and as they become large, the head is tilted farther and farther round on the top of the vertebral column, so as to throw more weight behind the point of support, to balance the weight in front: and this tilting takes place to a much greater extent in men than in women, because in women the face and forehead remain proportionally lighter.

From the foregoing considerations it must be apparent to every one that loftiness of forehead results from general height of the whole skull, and that the apparent form of the forehead is very dependent both on the amount of total cranial curvature and on the balance of the head on the vertebral column. The deceptiveness of mere general appearance may, perhaps, be best illustrated by noting how people speak of the large foreheads of children. The frontal emi-

nences of the child project forwards, and the head arches boldly above them, giving the appearance of a large forehead; but, in point of fact, the forehead of the child is proportionally very small and undeveloped; and its apparent prominence is due partly to the shallowness of the orbits, giving a comparative prominence to the frontal eminences, and partly to the whole skull being so set on the top of the spine that the forehead and face bones are turned more downwards than in the adult. The arch of the upper part of the child's forehead is afterwards lost, because it is turned back to lie more level on the roof of the head. So also, in the female, the head being not so much tilted up, there is a persistent upward arching of the roof of the skull, as it is traced backward, which is peculiarly feminine and graceful.

With regard to development of the back part of the skull, it has been justly remarked by some good observers, that fulness of that region appears to be quite as important as a full forehead; and it is instructive to note, that if a sketch be made of a head in profile, a change of expression, ranging from almost idiotic weakness to great strength of character, may be produced by varying the outline of the lower occipital region and back of the neck without altering any other portion. But the alteration of that line indicates not a mere addition to the posterior lobes of the brain or subtraction from them, but a change in the anatomy of the whole interior of the head, affecting the cerebral hemispheres throughout their extent.

So, also, those anatomists who have written as if the characteristic posterior lobes of the brain in man and apes were so much matter added to the back of the hemispheres, are really mistaken; for the hemispheres of a sheep rest against precisely the part of the cerebellum corresponding to that which they rest against in the human subject; but the human brain differs from that of the sheep in the vastly increased curvature and greater diameter of the cranial cylinder.

In bringing these cursory remarks to a conclusion, it is

only necessary to add, that the reader is not to imagine, because it has been argued that different faculties are not localized in different parts of the cerebral hemispheres, that therefore it follows that there is no connection between the shape of the head and the mental character. Let the reader who still preserves a lingering fondness for judging men by their appearance continue to take the skull into account, if he pleases; but let him be assured that whatever connection really exists is to be explained, not by the phrenological dogma, but as he would explain why massive chins are often conjoined with strong wills, different types of hand with different types of mind, well-built frames with healthy mental tendencies, and rickety bodies with eccentric, though often keenest-witted natures. The explanation is physiognomical.

While, however, this is probably the case with regard to the shape of the head, it is obvious that the relationship of the amount of brain to the mental faculties is more than physiognomical. Possibly an analogy may be drawn between the brain and a galvanic battery, and increase of the gray matter of the one be correctly compared with addition to the cells of the other; but as in an electric instrument the working is dependent on the delicacy and fitness of the arrangements quite as much as on the strength of the current which supplies them, so in the case of the mind the result is dependent on the distribution and balance of the faculties and inclinations, and on other circumstances, none of which are proved to have any connection with the mass of cerebral substance. Certain it is that, although there are probably mental characters peculiar to large and small brains respectively, the size of the skull is, as any observer may easily satisfy himself, no good guide to the mental endowments. —*Popular Science Review.*

THE CLAPPER RAIL.

BY DR. E. COUES, U. S. A.

THE Clapper Rail, otherwise called the Salt-water Marsh Hen, is a sea-side bird, inhabiting the marshes along our coast within reach of the tides, and rarely if ever straying inward. It goes as far north as Massachusetts, but only in summer, and is unfrequent or rare beyond the Middle States. Further south, however, it is one of the most abundant and characteristic of the maritime species. On the coast of North Carolina, for instance, it breeds in countless numbers, and remains nearly all the year—only becoming less numerous in winter, or perhaps disappearing altogether for a short time during the coldest weather. I presume that the reader is so familiar with the appearance of the bird, from seeing stuffed specimens, that I need say nothing on this score. But it may not be so generally known that the young birds, in the downy plumage, are jet black, with a faint gloss of green, looking much like newly-hatched chickens, except that the bill, and especially the feet, are longer. The former is flesh colored, the latter are dusky. And perhaps still less is known of the habits of this, as well as of other rails, which are particularly difficult to study satisfactorily. Rails live hidden in the marshes, and are not very often seen except when they fly up; so that how they live becomes a matter of some interest, as perhaps I may be able to show. We will begin with the eggs—*omne vivum ex ovo*, says Linnæus.

I have sometimes thought that the pains oölogists frequently take to measure eggs in hundredths of the inch, and describe their shape with mathematical exactitude, might be spared for something more profitable. I was never more struck by the fact that birds' eggs vary more than is usually

believed, than when looking over a peck, more or less, of these rails' eggs. They seemed to differ among themselves about as much as the same number of common fowls' eggs would. Let me illustrate by giving the measurements of half a dozen, selected as representing extremes :—

No. 1. The longest one, 1.80×1.10; elliptical, the ends about equally pointed; greatest diameter in the middle.

No. 2. The slenderest one, 1.66×1.00; same shape.

No. 3. A small one, 1.50×1.05; rather narrowly oval, pointed; greatest diameter across posterior third.

No. 4. A thick one, 1.60×1.16; a regular "oval" in shape.

No. 5. Another thick one, 1.70×1.20; like No. 4, but more obtuse at the small end.

No. 6. The shortest, and a very thick one for its length, 1.50×1.15; very broadly oval, or sub-spherical; diameter across the middle; scarcely appreciable difference between the two ends.

So the eggs of *Rallus crepitans* are an inch and two-thirds long, by an inch and one-tenth broad; narrowly or broadly oval; narrowly or broadly elliptical, or nearly spherical. The ground color ranges from a dull opaque white to a creamy or pale buff. They are rather sparsely, oftener very thickly, marked with spots evenly or very irregularly distributed over the surface; the spots varying from mere dots to large splashes, both on the same, or on different eggs. But when the markings vary in size on the same egg they are always largest and most numerous towards or at the butt, where also they are apt to run together; while they usually remain distinct on other parts of the shell. But it is not confluence of the small spots that makes the longer splashes; these are of a different character. The former are usually roundish, with a distinct contour; the latter have no definite shape. In color the markings are always reddish brown; whether paler or darker, they have the rusty or reddish tint, and are never pure brown. There are a number of other spots, more obscure than either of the foregoing, appearing as if in the shell instead of on the surface; these are some shade of lavender, lilac, or very pale purplish.

The number of eggs deposited varies; I never found more than seven in one nest, though I have been assured that eight or nine may be laid; six or seven is the average number, however. The laying season commences (here in North Carolina, at any rate) the last week in April, and continues until the middle of June, or later, as two broods are frequently raised. I found perfectly fresh eggs June 12th; and have seen barely fledged birds in August. But the second and third weeks in May are the great times for laying. Then, when the season is at its height, some idea of the countless numbers of rails in the marshes may be gained from the fact that baskets full of the eggs are gathered by the boys (and men too) and brought to the Beaufort market, where they sell for about five cents a dozen. When perfectly fresh they are very good to eat.

We occasionally read in books, scientific and otherwise, accounts of the nests of rails and coots being floated off by the tide without going to pieces, and the parent bird continuing to incubate, with undisturbed peace of mind, during the whole voyage. I suppose such a thing may have happened; at any rate, a lively imagination is well enough, and it is a pity to spoil a good story by asking impertinent questions. But I must say I never saw a rail's nest substantial enough to hold together for any length of time floating on the water; and, moreover, that a good deal that has been said about their being skilfully moored to tussocks of grass, rising and falling with the tide, etc., may be taken with much salt. In fact, destruction of numberless nests, addling of eggs, and drowning of newly-hatched young, are foregone conclusions from every unusual rise of the tide, as during a severe storm. A great tragedy of this sort happened at Fort Macon, on the 22d of May, 1869, when, and for two or three days afterward, the marsh, ordinarily in greatest part above water, was flooded—only here and there a little knoll breaking the monotony of the water. There was a terrible commotion among the rails at first, in prospect

of the common calamity; and the reeds resounded with their hoarse cries of terror. But as the waters advanced, and inundated score after score of homes, the birds became silent again as if in unspeakable misery. Driven from their concealment, anxious or terrified, as the case might be, they wandered in listless dejection over beds of floating wrack, swam aimlessly over the water, or gathered stupefied in groups upon projecting knolls. Few of the old birds, probably, were drowned, but most of the young must have perished. A dark day for the rails!

As if to guard somewhat against such an accident, the rails generally build their nests around the margins of the marsh, or in elevated and comparatively dry spots in its midst, just about at the usual high water mark. The nest is always placed on the ground, in a bunch of reeds or tussock of grass, or clump of little bushes. It is an artless flimsy structure, made of dried grasses, or reed stalks broken (probably bitten) into pieces three or four inches in length, laid crosswise and matted together, but scarcely intertwined. It is simply a platform of such materials, say a foot in diameter, and two or three inches thick, slightly hollowed in the middle. Sometimes it is barely thick enough to keep the eggs from the wet; sometimes quite a heap of materials is made; this seems to depend in great measure upon the comparative dryness of the situation selected. But in any case the nest is so frail and so bulky that it is difficult or impossible to lift it up without its coming to pieces.

The rail is not a natatorial bird properly speaking. It has only a very slight basal web, and no vestige of a marginal fringe or lobe along the toes. Nevertheless, it swims very well, at least for short distances. I have often seen the birds take to the water by choice, not from necessity; and noticed that they swam buoyantly, if not very fast, and with perfect ease; much like coots, for example. In consequence of the compressed shape of the body, they rest rather deeply in the water; but carry the head well elevated,

the neck drawn back, and the tail cocked up. They are poor flyers, as every one knows; so poor, it seems, that it is somewhat a matter of surprise that some of the family perform such extensive migrations. When started on wing, a thing not easy to effect, except at high tide, they fly up in a remarkably weak, vague way, flap hurriedly a little distance, and settle suddenly again, with a peculiar motion of the wings, as if simply letting themselves drop. This circumstance makes these and other kinds of rails—they are all alike in this respect—the very easiest of all birds to shoot on the wing; and is one reason, perhaps the chief, that so many people are fond of rail-shooting. The birds in fact are not distinguished either as flyers or swimmers; their strong point is walking. As walkers, they have "few equals and no superiors." A glance at their long strong legs is sufficient to establish this fact, without the trouble of going into a marsh, and observing how every square foot of soft mud is marked with the impress of their feet—all the impressions made of course since the last tide. The rails' attitudes are not easily learned; when seen, the birds are generally in too much of a hurry for this, but some of their poses are extremely graceful. Audubon has caught them best of any one who has attempted their delineation. As any one will notice, who has an opportunity of seeing a rail leisurely stepping about, in fancied security, there is a connection between the muscles of the tail and legs. With every step there is a corresponding jerk of the tail, apparently involuntary, and regular as clock-work. The same movements are repeated by the head and neck, as in most birds; they all tend to secure in equilibrio the forces acting upon the centre of gravity, as this is thrown now over one, now over the other leg. The remarkable compression of the body, that enables the birds to pass between close-set reeds, need not be enlarged upon. The expression "thin as a rail," refers, I take it, to these birds, and not to what fences are made of; at least, if it doesn't, it might.

In the matter of food the Clappers are not over particular. They feed indiscriminately on all the small animals they find in the marsh, as well as on seeds. The little crabs known as "mud-fiddlers," however, are, in this locality, the chief article in their bill of fare. These have squarish bodies, generally less than an inch long; the smaller ones are swallowed whole; the larger ones get their legs, and particularly their one great claw, beaten off, before they find rest at last in a rail's gizzard. If one has the patience and good luck to be able to watch rails when the birds are securing and disposing of their prey, he will see that they do it much after the fashion of the smaller herons, as the Green, for instance. But the rails race after their meals more than herons do; there is less patient lying in wait, and altogether less "action" in the final blow.

Rails are among the most harmless and inoffensive of birds. All that they seem to want is to be let alone. But when wounded and caught, they make the best fight they can, and show good spirit. The bill is too slender and weak to be much of a weapon, and they scarcely attempt to use it; relying rather upon their sharp claws, which they employ to considerable effect.

A colony of rails, goes far towards relieving a marsh of part of its monotony. Retiring and unfamiliar as they are, and seldom seen, considering their immense numbers, yet they have at times a highly effective way of asserting themselves. Silent during a great part of the year, or at most only indulging in a spasmodic croak now and then, during the breeding season they are about the noisiest birds to be found anywhere. Let a gun be fired in the marsh, and like the reverberating echoes of the report, a hundred cries come instantly from as many startled throats. The noise spreads on all sides, like ripples on the water at the plash of a stone, till it dies away in the distance, only however to be repeated again upon the slightest provocation—or none. In the morning and evening, particularly, the rails seem perfectly

reckless, and their jovial, if unmusical, notes resound till the very reeds seem to quake. It is as if some irresistible joke was going the rounds, making every bird laugh outright as soon as it was told. With scarcely a change of name, in fact, the Clapper Rail's nature, and function in bird-society, is perfectly expressed. It should be spelled in French style —*claqueur*. Unobtrusive, unrecognized except by a few, almost unknown to the uninitiated, the birds steadily and faithfully fulfil their allotted parts; like claqueurs they fill the pit, ready at a sign, to applaud anything—or nothing—that may be going on in the drama of life before them.

I do not wish to be tedious; but I have a story that I can vouch for as being something new. It is "another rail-road accident;" when will public opinion force the companies to be more careful? Suppressing an obtrusive pun upon iron and other rails, for it is unbecoming to joke over a melancholy case of suicide, I will merely say that a rail was found lying dead upon the track that divides two pieces of marsh at Fort Macon. Now we have all read certain singular stories, perhaps in "Ord's Wilson," to the effect that rails are subject to remarkable spells of fear or anger, or something of that sort, that throw them into epileptic fits. I thought at first, here was a real case in point; for the bird was dead, yet without a sign of external violence, even so much as the ruffling of the plumage. Stooping to pick him up, however, I found that he had got both legs wedged fast in the crack between the ends of two contiguous rails; he was in fact so firmly caught that I had some little trouble in liberating his dead body. He had evidently tried to walk between the rails instead of stepping over them; but how he ever managed to "put his foot in it" so effectively I cannot imagine, for there was not a fourth of an inch of space. Still the fact remains. In the inquest held upon this unlucky rail—victim of the "blind decrees of fate," as the novelists say—I discovered abundant cause of death, without falling back upon any hypothesis of mental emotion. He had beat him-

self to death against the iron. Both shoulder blades and one coracoid were broken; the other coracoid was dislocated; there was a double fracture of the merry-thought, and a crack in the keel of the breastbone; while all the muscles of the breast were terribly bruised, and full of blood-clots.

REVIEWS.

HUXLEY'S CLASSIFICATION OF ANIMALS. *Continued from Page 546.* — Professor Huxley very clearly sets forth the characteristics of the group, or Subkingdom, of VERTEBRATA, and as plainly indicates the three Provinces into which it is divisible, viz: I. The ICHTHYOPSIDA, comprising the Fishes and Amphibians; II. The SAUROPSIDA, comprising the Reptiles and Birds; III. The MAMMALIA. These three groups are certainly well marked, and the affinities of their members have for a long time been noticed and agreed to. No one can doubt the close relationship existing between the Fishes and Amphibians (Salamanders, Frogs, etc.,); and since the discovery of the remarkable fossil form of *Archæopteryx*, which has been placed alternately in the classes of Reptiles and Birds, the characters of these two classes have been so thoroughly sifted as to prove their close affinity; neither can the distinctive characters of the class of Mammalia be questioned, though as has often been pointed out, and as Prof. Huxley also insists upon, the Mammals, Birds and Reptiles, or the *Abranchiate Vertebrata*, have certain characteristics in common, distinguishing them from the equally well defined group of Amphibians and Fishes, or the *Branchiate Vertebrata*.

In adopting M. de Blainville's three primary divisions of the Mammalia, as characterized by the reproductive organs, especially those of the female, Prof. Huxley states that he does "not mean to assert that M. de Blainville defined these different groups in a manner altogether satisfactory, or strictly in accordance with all the subsequently discovered facts of science, but his great knowledge and acute intuition led him to perceive that the groups thus named were truly natural divisions of the Mammalia. And the enlargement of our knowledge by subsequent investigation seems to me, in the main, only to have confirmed De Blainville's views." These primary divisions, or subclasses, are the *Ornithodelphia*, containing only the genera Ornithorhynchus and Echidna; the *Didelphia*, or the Marsupials; and the *Monodelphia*, embracing all the rest of the orders of the class, which, from "placental" characters, he places in five groups. Without either endorsing or attempting to disprove Prof. Huxley's views in relation to the special classification of the Mam-

malia, we will simply compare the results of his system with those of the equally carefully considered one of Owen published ten years before. Both are strictly anatomical and confined (so far as tabulating the results are concerned) to one set of organs: Owen taking the modifications of the brain; Huxley the generative organs, or more especially the uterus and the placenta in connection with the development of the embryo.

Owen divides the Mammalia into *four* subclasses; Huxley into *three*.

Owen's first three subclasses (the *Archencephala*,—Man; the *Gyrencephala*,—Ape, Lemur, Dog, Bear, Seal, Hog, Sheep, Horse, Tapir, Elephant, Manatee, Whale, etc.; and the *Lissencephala*,—Sloth, Armadillo, Anteater, Bat, Mole, Hedgehog, Shew, Hare, Rat, etc.) are contained in Huxley's subclass *Monodelphia*.

Owen's fourth subclass (*Lyencephala*,—the Marsupials, and Echidna and Ornithorhynchus) is divided into two subclasses by Huxley, corresponding to the two *orders* of Owen, viz: subclass *Didelphia* of Huxley=order Marsupialia of Owen; and subclass *Ornithodelphia* of Huxley=order Monotremata of Owen.

The result of this comparison of two anatomical systems is favorable to the generally received orders of the class being established on firm grounds, for, with the exceptions following in parenthesis, both Huxley and Owen, though investigating from different stand points, have kept the orders intact, and have only changed the order of their relation, or succession, in accordance with the views each has taken regarding the value of groups more comprehensive than orders. (Man is considered by Owen as differing from all other Mammals in the cerebral character, and hence considered as a subclass; while Huxley, from the identity of the placenta with that of the Apes, Lemurs, Insectivora, Chiroptera and Rodentia, unites him with them in the group of Monodelphia with a *discoidal deciduate placenta*, but retains him as a suborder of the order of PRIMATES, which contains two other suborders, the *Apes* and the *Lemurs*, corresponding to Owen's order of Quadrumana. Huxley unites Owen's orders Perissodactyla and Artiodactyla—containing together the Tapir, Horse, Sheep, Hog, etc.—as two suborders under his order of UNGULATA, which, with the Cetacea, are united in a group characterized by the *non-deciduate placenta*. Huxley considers the genus *Hyrax* as the sole representative of a distinct order, removed to the next group, with the Proboscidia and Carnivora, having a *zonary deciduate placenta*).

After noticing the results of this hasty comparison, may we not ask why the character of the brain (provided the results are well founded by examination in such a manner as to leave no doubt of their correctness) should not be as good a guide as the anatomical structure of the uterus and placenta? It has been stated that in some respects the Cerebral system is liable to lead to errors. On the other hand, we read in Huxley's work that there is doubt as to the real position that some of the animals should hold in his system, on account of the very character he has taken for the basis of his classification not being known in some, and in others

liable to be differently understood, and he admits (p. 72) that the placenta, the peculiar character of which he takes for his guide in defining the five groups of the Monodelphia, is "a structure not universally characteristic of the class." With these exceptions and gaps taken into account, in addition to the limitation of the placental characters to one sex, is not the Cerebral system as likely to lead to a natural grouping of the orders of Mammalia as one based on the reproductive organs?

From what we have stated it must not be supposed, by those who have not yet read Prof. Huxley's invaluable résumé of the classification of the Mammalia, that the author has confined himself to considerations resulting from the study of the reproductive organs, for, on the contrary, while their peculiar structure, and the development of the embryo and its relation to the parent, forms the basis of his division of the class into three subclasses, and the structure of the placenta that of the five secondary groups of the principal subclass; he also gives other characters common to each group, and in his summary of the orders he brings together their principal structural elements, and discusses their relations from other stand points, for an understanding of which we must refer the reader to the work itself.

Without farther comments — other than to state that it is our belief that the orders of the birds will require farther confirmation before they are generally adopted by ornithologists, and remarking that the orders of the Reptilia and Amphibia are mainly those now commonly received — we give the groupings of his second Province, the SAUROPSIDA.

Class I. BIRDS (*Aves*), he divides into three orders: — (1) SAURURÆ, containing only the extinct form, *Archæopteryx;* (2) RATITÆ, containing the Ostriches, Emeus, Apteryx, etc.; (3) CARINATÆ, containing all the ordinary birds.

Class II. REPTILES (*Reptilia*), he divides into four orders of living and five of fossil forms: — (1) CROCODILIA (Crocodiles, Alligators, and their allies); (2) LACERTILIA (Lizards, Blindworms and Chameleons); (3) OPHIDIA (the Snakes); (4) CHELONIA (the Turtles and Tortoises). The five orders represented only by fossils are the ICHTHYOSAURIA, the PLESIOSAURIA, the DICYNODONTIA, the PTEROSAURIA and the DINOSAURIA.

The third Province, the ICHTHYOPSIDA, containing the classes of Amphibians and Fishes, is arranged as follows: —

Class I. AMPHIBIANS (*Amphibia*). Four orders: — (1) URODELA (the Newts, Salamanders, Sirens, etc.); (2) BATRACHIA (the Frogs and Toads); (3) GYMNOPHIONA (the Cæcilians, etc.); (4) LABYRINTHODONTA (fossil forms).

Class II. FISHES (*Pisces*). Six orders: —(1) DIPNOI (containing only the singular "Mud fishes," *Lepidosiren* and *Rhinocryptis*); (2) ELASMOBRANCHII (Sharks, Skates, and Chimæras); (3) GANOIDEI (Sturgeons, Garpikes, Dogfish (*Amia*), etc.); (4) TELEOSTEI (the ordinary "Bony" fishes); (5) MARSIPOBRANCHII (Lampreys, etc.); (6) PHARYNGOBRANCHII (represented by the single genus *Amphioxus*).

In this classification of fishes Prof. Huxley has simply followed the groups of Müller, given twenty-three years ago, but has lowered the rank of the groups from subclasses, as they were considered by Müller, to orders. These groups are undoubtedly well founded, but their equality of rank may be questioned. The *Dipnoi* are very Amphibian in many of their characters, and the typical *Ganoidei* are equally Reptilian in some of theirs, both agreeing, however, in much that is important in their anatomy (five out of the eleven characters assigned by Huxley to Dipnoi being common to the Ganoidei as well, and the other six characters are either of an aberrant or embryonic nature). The *Elasmobranchii* are equally an aberrant group, with affinities to the higher classes of Birds and Mammals. The *Marsipobranchii* are low, degradational, or embryonic forms, when relatively considered with the other groups of the class; and the single genus of the *Pharyngobranchii* is of so low an embryonic type that it must be considered as representing a distinct subclass, unless the embryology of the lower Marsipobranchiates shall prove it to be the lowest order of that subclass. The *Teleostei* are the most fish-like of fishes, agreeing more nearly with the Ganoidei than with the other groups. Are these six groups of equal value? and if so do they rank as subclasses or as orders? and what is the rank of the groups into which all but the Dipnoi and Pharyngobranchii are most naturally subdivided? If the same considerations used to discriminate the orders among Mammals, Reptiles, or Amphibians be applied to the fishes, will not the secondary divisions of the groups Teleostei, Elasmobranchii, Ganoidei and Marsipobranchii by force be considered as orders? On these considerations we agree with Prof. Gill, who in 1861, in a discussion of the subject of the higher groups among fishes (Proc. Philad. Acad Nat. Sci.), united the Dipnoi with the subclass of Ganoids, considering them only of equal rank with his other three orders of the subclass. The Pharyngobranchii, which Prof. Gill considers as an order of the Marsipobranchii, we keep as a distinct subclass, subject to change on farther knowledge of the embryology of the Marsipobranchiates.

Our views of the higher groups might be expressed thus:—

Class PISCES.
Typical.
Subclass TELEOSTEI.

Aberrant.	*Aberrant.*
(Mammalian and Avian.)	(Reptilian and Amphibian.)
Subclass ELASMOBRANCHII.	*Subclass* GANOIDEI.

Degradational.
Subclass MARSIPOBRANCHII.

Embryonic.
Subclass PHARYNGOBRANCHII.

We confess ourselves much disappointed in that part of the work which relates to the Mollusca. Though the general facts and special details of the anatomy are clearly stated, no notice is taken of the plan or arche-

typal characteristics of the branch, which were admirably defined by Carpenter in 1854, and by Dana in 1863, and Mr. Morse in 1865,* and nothing is said of the embryology of either the animals or the shells, omissions which are unpardonable in an essay on classification.

The subdivision of the branch into Mollusca and Molluscoida also appears to us objectionable. If Prof. Huxley had drawn his dividing line between the Lamellibranchs and Pteropods we should have had an eminently natural division of the Mollusca, but in placing the line between the Lamellibranchs and the Ascidians he repeats a common error.

The Polyzoa, Brachiopoda, Ascidia and Lamellibranchiata have to the Pteropoda, Gasteropoda and Cephalopoda, within their own type, a negative relation comparable to that which the invertebrata have to the vertebrata; they are, when contrasted with the last three classes, as a whole, without a special cephalized extremity. All the three higher classes have the cephalic region distinctly differentiated from the mantle, or cœnœcial region, whereas in all the lower classes the organs of this region are buried in the mantle, or cœnœcial region, except among the Polyzoa, where they are distinct from the cœnœcial region; and may be extended in the higher genera, but this differentiation is gained only by elevating the cephalic organs to the posterior pole of the body.

The close structural affinities of the Polyzoa and Brachiopoda are noticed; the two divisions are placed in their correct sequence, and their relations to the Ascidia are defined with equal precision and correctness; but the author fails to see the close affinity of the latter to the Lamellibranchiata. Nevertheless the differences between the structure of the Lamellibranchs and Ascidians are no greater than those existing between the structure of the Polyzoa and the Brachiopoda, whilst the homologies existing between the Ascidia and the Polyzoa are of a much more general character than those existing between the Ascidians and the Lamellibranchs.

The Polyzoa and Brachiopoda together may be considered as one anatomical type, and defined as a sac closed at one end by a disc, surrounded by free tentacles, and perforated by an edentulous mouth from which hangs the alimentary canal.

Among the Ascidia and Lamellibranchiata on the other hand the tentacles, or gills, are always joined by an intermediate membrane, and they together with this membrane form either an open or closed pouch perforated at its lower end by the mouth, from which hangs the alimentary canal.

The atrial chamber has but one aperture in an invaginated Polyzoön or a Brachiopod, whereas with the Ascidia and Lamellibranchiata there are two. The muscular systems of the Brachiopoda and Polyzoa are complicated and homologically similar, as shown by several writers,

* Carpenter's Comparative Physiology, Dana's Manual of Geology, and Mr. Morse's Classification of the Mollusca in the Proceedings of the Essex Institute.

whereas the Ascidia have no distinct muscles which can be compared to those intersecting the visceral cavities of the Polyzoa and Brachiopoda.

Mr E. S. Morse has lately shown (September number of the NATURALIST) that the closest resemblance exists between the young of Terebratula and the adult Polyzoön, so close that there would be no hesitation in placing them in the same class, if the characteristics of the former were permanent.

In fact we cannot coincide with those who consider that the principles of the Cuvierian classification are endangered by Mr. Huxley's book. While no champion of all of Cuvier's principles, we cannot but regard any work which wholly sets them aside as very deficient in comprehensiveness; it must necessarily substitute a multitude of details for the very general anatomical statements by which four out of the five great branches of the animal kingdom are usually defined.

THE SHEFFIELD SCIENTIFIC SCHOOL.*—Prof. Verrill reports that the want of funds in the Zoölogical department has prevented the usual increase of specimens, but that the time has been turned to good account in cataloguing and classifying the general collection, and writing monographs of separate groups. Mr. S. I. Smith has monographed a part of the Decapods, and Prof. Verrill the Polyps and Corals of the west coast of America, and described numerous new forms.

The Geological department, under the direction of Prof. O. C. Marsh, has received several very valuable additions. Among these the most remarkable is a slab with twenty-one footprints of the Otozoum upon it, each of which is about fifteen inches in length. The slab is of a correspondingly gigantic size, measuring twenty by thirty feet.

We have not space to review other departments, but regret to notice that all of them seem to be laboring under pecuniary difficulties.

At Yale we really have a Scientific School, one which gives young men a general knowledge of science and the arts as well as a more intimate acquaintance with some special branch.

The advantages presented by the school in its mode of organization, its corps of instructors and the objects which it seeks to attain for all its students, are of the highest order. We hope, therefore, that the pecuniary hindrances to the future progress of an institution, so important to the general interests of education in this country, may be speedily removed.

NEW ECHINODERMS AND CORALS.†—In this paper Prof. Verrill describes seven new species of Echinoids, five of Asterioids, six of Ophiuroids, and six new species of coral, with one new genus among the Eupsammidæ.

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* Fourth Annual Report of the Sheffield Scientific School of Yale College, pamph., 8vo, 76 pp. New Haven, 1869.

† On New and Imperfectly Known Echinoderms and Corals. By A. E. Verrill. Ext. Proc. Bost. Soc. Nat. Hist., Vol. xii, pp. 382–96.

THE RULES OF ZOÖLOGICAL NOMENCLATURE.* — In republishing these rules accompanied by many valuable notes and comments, Prof. Verrill has done good service to zoölogy in this country. A copy of these rules and those of the British Association, reviewed by Prof. Gray in a previous number of Silliman's Journal, should be in the hands of every zoölogist.

NATURAL HISTORY MISCELLANY.

BOTANY.

ARTIFICIAL PREPARATION OF SUBSTANCES FOUND IN PLANTS AND ANIMALS. — Dr. Debus, the President of the Chemical Section of the British Association, states: "It has already become possible to prepare in the laboratory bodies of a very complex character, and which a few years ago were only found in the bodies of animals or plants. Alizarine, the beautiful compound of the madder-root, has been obtained by artificial means in the course of the year by Messrs. Liebermann and Græbe. Results of such a nature render it highly probable that, at no distant period, it will be in our power to prepare, artificially, nearly all, if not all, the substances found in plants and animals. Here I must not be misunderstood. Organic structures, such as muscular fibre or the leaves of a tree, the science of chemistry is incapable of producing, but molecules, like those found in a leaf, or in the stem of a tree, will no doubt one day be manufactured from their elements. — *Scientific Opinion.*

MAPLE-SEED, THREE WINGED. — I know not if it be common, and, therefore, ask for information, but on a tree of the *Acer saccharinum*, or sugar maple, in the Central Park in this city (New York) I found, a few days since, a three-winged seed. The description of the genus says, "ovary 2-celled. From the back of each ovary grows a wing, converting the fruit into two 1-seeded, at length separable, closed samaras or keys." (Gray.) I only found this one, though the trees were covered with seed, and I searched pretty carefully for more. — A. M. E.

ZOÖLOGY.

KINSHIP OF ASCIDIANS AND VERTEBRATES. — The number of Max Schultze's Archiv (v. 4), just published, contains a letter to the editor from Prof. Kupffer of Kiel, in which that distinguished embryologist asserts that he has been studying the early history of a species of Phallusia, and that his results in large measure agree with those of Kowal-

* From the American Journal of Science and Arts, November, 1869, at Naturalists' Agency 27 cents.

ersky touching the startling vertebrate features of the early condition of these invertebrata. He reserves for the present the details about the exact formation of the nervous system, but quite confirms the fact of the existence of a notochord. He says: "At this stage one could not imagine a more beautiful model of a vertebrate embryo, with the neural tube on one side of the axis and a visceral tube on the other." He, moreover, describes in his species of Phallusia the neural tube as not merely an almost spherical vesicle, but as prolonged in the form of a fine hollow thread into the tail above the notochord or axis. He promises full details shortly, and we hope to be able to return to this most important matter.—*Nature, London.*

HOUSE WRENS.—I have had the pleasure of being acquainted with these little birds (*Troglodytes ædon*) for several years. They have bred in and around my house, until they have become so tame as sometimes to allow the children to handle them. They have become so numerous that I do not furnish boxes for all, and they make nests in many singular places; among others, in a bullet-pouch up chamber, a soldier's knapsack in an outbuilding. In both of these places the birds succeeded in rearing a brood. But the most singular place selected for a nest was the wooden stirrup of a saddle hanging in a shed, in which, however, the birds did not prosper, as the saddle was often used. They carried small dry twigs and other rubbish, consisting of pieces of steel wire, dried snakes' skin, etc., into the knapsack, enough to have filled a half bushel measure, filling the entire cavity, except a little corner which they lined with feathers, where they laid seven or eight eggs. I also noticed their superior instinct, if not reason, whilst building in a box near my kitchen door. The hole in the box would not admit the long twigs the birds tried to get in, and they fell to the ground. After many efforts and failures the wrens concluded by making a scaffolding, which they succeeded in doing by taking in several shorter sticks endwise, letting the ends project out of the hole; then they proceeded by laying the long twigs on these projecting ends, then getting into the box, and by sliding the long twig endwise until the end came opposite the hole, they pulled it in. I was amused to see one trying to carry a large nail heavier than itself. They are amusing little fellows in many ways. Their song is melodious, loud and clear, and I have often wondered that such loud music could be produced by anything so small.—WM. J. MCLAUGHLIN, *Centralia, Kan.*

DEEP SEA DREDGING OFF THE BRITISH ISLES.—Our Admiralty, at the instance of the Royal Society, placed a war steamer at its disposal for sounding, dredging, taking deep sea temperatures, and making other physical investigations. The steamer left about the middle of May; and I had charge of the expedition for the first cruise of two months. Prof. Wyville Thomson succeeded me; and Dr. Carpenter followed. We dredged at depths varying between ten and two thousand four hundred and thirty-five fathoms, everywhere getting mollusca, crustacea, and other inverte-

brate animals, in a living state. This expedition embraced the Atlantic Coasts of Ireland, the Hebrides, and Shetland. There was not any trace or indication of the Gulf Stream, but on the contrary, a northern fauna even as far south as Ushant. Many novelties occurred.—J. Gwyn Jeffreys (*in a letter to one of the editors*).

The Kingfisher's Nest.—I have watched with some interest all that has been said in the Naturalist about the breeding habits of this species, to see if my experience would be justified by that of any other observer. This has been nearly accomplished by Mr. Jones in the March number.

On the 18th of March, 1868, I collected eggs from two nests built near a mill-pond, in the excavation for the dam. Each hole was three feet deep; one elbowed to the right, the other to the left. In one was six eggs, in the other seven; all fresh. Each nest was composed of dry fish scales and small dry fish bones mixed with small pebbles of the size of a small pea. The scales and bones were free from smell, and were white and pure, and in each nest amounted to a fair handful.

About the first of June, 1869, on landing from a fishing excursion on one of our small lakes, I observed what I took to be a kingfisher's hole in a sandbank on the shore. While my bait and tackle were being loaded, I took a paddle and began to dig it out. The sand was soft and I proceeded five feet very rapidly, when the bird came rushing out. I went on digging with renewed hopes and made seven feet, when the paddle was no longer available for insufficient length, and I abandoned the job.—D. Darwin Hughes, *Marshall, Mich.*

Spectrum of the Fire-fly.—The spectrum given by the light of the common Fire-fly of New Hampshire (*Photinus?*) is perfectly continuous, without trace of lines either bright or dark. It extends from a little above Fraunhofer's line C, in the scarlet, to about F in the blue, gradually fading out at the extremities. It is noticeable that precisely this portion of the spectrum is composed of rays, which, while they more powerfully than any others affect the organs of vision, produce hardly any thermal or actinic effect. In other words, very little of the energy expended in the flash of the Fire-fly is wasted. It is quite different with our artificial methods of illumination. In the case of an ordinary gas light the best experiments show that not more than one or two per cent. of the radiant energy consists of *visible rays;* the rest is either invisible heat or actinism; that is to say over ninety-eight per cent. of the gas is wasted in producing rays that do not help in making objects visible.—C. A. Young.

Death of B. D. Walsh.—We regret to record the death of Mr. B. D. Walsh, the State Entomologist of Illinois, and the Senior Editor of the "American Entomologist," and former Editor of the "Practical Entomologist." For these duties he was admirably fitted. As an enthusiastic and thorough naturalist the small band of entomologists in this country will mourn his loss.

GEOLOGY.

A FOSSIL TUBULARIAN.—Dr. P. Martin Duncan has discovered, conjointly with H. M. Jenkins, a new genus of tubularian Hydrozoa from the Carboniferous formation. It is called Palæocoryne, and was described in a paper read at one of the late meetings of the Royal Society. *Palæocoryne* is a new genus containing two species, and belongs to a new family of the Tubularidæ. The forms described were discovered in the lower shales of the Ayrshire and Lanarkshire coal-field, and an examination of their structure determined them to belong to the Hydrozoa, and to be parasitic upon Fenestrellæ. The genus has some characters in common with Bimeria (Str. Wright), and the polypary is hard and ornamented. The discovery of the trophosome, and probably part of the gonosome of a tubularine hydrozoön in the Palæozoic strata brings the order into geological relations with the doubtful Sertularian Graptolites of the Silurian formation, and with the rare Medusoids of the Solenhofen stones. —*Popular Science Review.*

ANSWERS TO CORRESPONDENTS.

A. E. T., Springfield, Ohio.—Your aquatic plant is a Bladderwort (*Utricularia intermedia*), one of many species found in the United States in ponds, either floating free or rooting in the mud on the margin of the water. The name is derived from the little bladders which support it in a floating condition. The flowers are very pretty, usually yellow, but in some species purple.—J. L. R.

S. M. C., Otisco, N. Y.—The best work on American Neuroptera is Hagen's Synopsis of the Neuroptera, published by the Smithsonian Institution. It may be had at the Naturalist's Book Agency. The best account of our Orthoptera is to be found in Harris's Treatise on Insects Injurious to Vegetation. The Smithsonian Institution have also recently published Mr. Scudder's List of Orthoptera, which is very necessary for the student. We have observed caterpillars infesting herbaria in winter. Please send us a specimen of the Eudryas grata-like pupæ found boring into the side of the wood, so that we can determine what it is. We did not know that *Vanessa Antiopa* fed on Indian corn, or that *Œdema concinna* fed on the poplar. These caterpillars will sometimes change their food plant.

R. B., Newberne, N. C.—The spiders are *Epeira riparia* Hentz, and *E. cancer* Hentz. The eggs of the latter, enclosed in a greenish yellow cocoon, hatched out in October. The young were of the rounded form of *E. vulgaris*, differing greatly from the angular, spiny, transversely oblong form of the adult.

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SKATES' EGGS AND YOUNG.

BY F. W. PUTNAM.

It is an interesting fact that while the class of bony, or *true* Fishes, both fresh water and marine, are, with very few exceptions, oviparous, and lay immense numbers of eggs, the *Selachians*, or sharks and skates and their allies, are, with equally few exceptions, viviparous, and bring forth but few young at a time. One of the exceptions to the rule of viviparity among the Selachians is the genus *Raja*, to which our common species of skates and rays belong. Though the fact that skates lay eggs has been known for centuries, still to this day there is probably no class of objects picked up by the wanderer on the sea beach that excites curiosity so much as the egg cases of the several species of skates, after he has found out what they are. On being seen for the first time, and before close examination, I venture to state that the majority of persons regard them as some vegetable production, and pass them by as the supposed "bladder" of the seaweed with which they are often so closely connected by their tendrils as to have the appearance of being part of the plant, which they also greatly resemble in color and general appearance.

Some sharp eyed fisherman long ago, ascertaining that the

queer shaped things which he found on the beach were in fact little pockets, or sacks opened at one end, not knowing what else they could be, concluded that in some way they must be connected with the "maids of the ocean;" and what more natural than to suppose them to be the purses to hold the pearls and other valuables of the mysterious maids? and what better name than "Mermaid purses" could be desired? From this first christening, and following the common rule adopted for such cases—that of keeping as far away as possible from the real nature of the object—they have been called, and are generally known as "sea purses" and "sailor's purses." The only popular name bearing on their real origin is that given to them on some portions of the English coast, where they are called "skate barrows," from their resemblance in form to a hand-barrow, and the knowledge of the christener that they were produced by the skates.

As common as these egg cases are on our beaches, it is very seldom, and only at certain seasons, that they are found containing the egg or embryo. When fresh and filled by the embryo they are plump and swollen and of a much lighter olive color than when empty, dry and shrivelled. As long as the embryo is in the case no opening to the pouch can be detected, until just at the time when the young skate is to make his way into the world and commence his struggle for existence, consisting principally in keeping himself from going into the ever ready mouths of his own kin of fin, to whom he forms a tempting morsel. Just as incubation comes to a close, then, the substance at one end of the case softens and the upper and under layers are pushed apart by the young skate who "noses" his way out; the two layers then spring back into place and the case on drying shows no sign of an opening, unless it is again softened and the layers carefully separated.

We do not yet know the breeding season of our species, but Pennant in his "British Zoölogy," states that the "skates generate in March and April, at which time they swim near

the surface of the water, several of the males pursuing one female; and adhere so fast during coition, that the fishermen frequently draw up both together, though only one has taken the bait. The females begin to cast their *purses* in May, and continue doing so till September. In October they are exceedingly poor and thin, but in November they begin to improve, and grow gradually better till May, when they are in the highest perfection. The males go sooner out of season than the females."

We extend this quotation from Pennant to take in that part of the paragraph relating to the *condition* of the fish purposely, in order to call attention to the great waste of food on our New England coast. Here, to tell a person that a skate is good eating is about the same as to tell him that the horse is good eating. His reply will be, "you may eat it if you wish but I would rather have something else," and yet the skate and the horse are good wholesome food, which we should probably enjoy after we got used to it. In many parts of Great Britain and France, to say nothing of China, skates of a tender age, *i.e.*, about half grown, when they are called "maids," and also many sharks are considered good and wholesome food, and are regularly sold in the markets. Our Celestial friends on the Pacific coast have brought skates and sharks into demand in that region, and in time we shall have the benefit of their custom here, when skates and sharks will be caught for other purposes than the making of "pure Cod liver oil;" but until the Celestial element predominates over the Celtic, salt-cod and herrings will hold sway over the poor Selachians now condemned to die for their *livers* sake alone.

Another clause in the quotation from Pennant leads us to say a word or two, before turning again to our skates' eggs.

The male skates and sharks have appendages to the ventral fins which have been called claspers, from their supposed use in the act of coition. These appendages are in reality the intromittent organs of the male, and what were called

the legs of the monster shark exhibited about the country during the last two seasons, and familiar to every one from the newspaper descriptions and figures as "the great unknown animal, half fish, half quadruped," captured off Eastport, were simply these organs.

The skates and rays and the genus *Scyllium*, or spotted sharks, and their near allies, all lay eggs, contained in and protected by the singular horny cases, or shells. These cases are of various sizes and shapes according to the species of skate or shark by which they are laid. Their general form is that of the skates' figured in this article, but others are much larger, and those of the sharks are longer and narrower than the skates. On the coast of California a very large case is often found which always contains more than one egg, generally three. I remember one, received at the Museum of Comparative Zoölogy about twelve years since, that was several inches in length and contained three nearly developed embryos.

All these egg cases are provided with a more or less developed horn at each of the four corners. These horns are hollow, and are in fact tubes for the passage of water to the inside of the case and its exit at the other extremity of the sack. By this means the egg and tender embryo while protected by the horny covering or case, is furnished with a constant supply of water during its development. On the side of the case are numerous tendrils or filaments, by which the case is firmly fastened to seaweed, and hence it is that it is only after a violent storm that fresh cases are to be found on our beaches.

A few interesting questions which have not yet been fully solved, are: How do the cases become attached to the seaweed? Are the tendrils fastened by the mother skate in any way, or are they, when soft and fresh, so arranged that they naturally twine around the seaweed as soon as they come in contact with it? Does the skate when about to deposit her eggs go to a spot where seaweed is abundant, or

does she cast them at random and trust to the cases drifting to some suitable place for attachment?

That the mother when about to deposit her eggs selects a proper place for their attachment, just as other species go to regular spawning grounds, is, I think, proved by Mr. Thompson in his "Natural History of Ireland," who even asks the question if it is not probable that, like certain species of birds, the same fish (in this instance one of the spotted sharks) may return time after time to the same spot to deposit her eggs. This query arose from the fact that there were sent to him in December, 1843, two plants of the tangle (*Laminaria digitata*) dredged together from a depth of between two and three fathoms, to one of which was attached fourteen of the large ova and to the other twelve. "Of the fourteen six were very old [and empty], six of middle age [and empty], and two quite fresh [*i.e.*, with undeveloped eggs]. Of the twelve on the other plant, four were very old, four of middle age, and four were fresh." Now if this does not prove that all these eggs were deposited at three different seasons by the same fish—which, with Mr. Thompson, I believe is probable—it certainly proves that the fishes seek a proper place for the attachment of their eggs and do not leave them to the mercy of tide and wave.

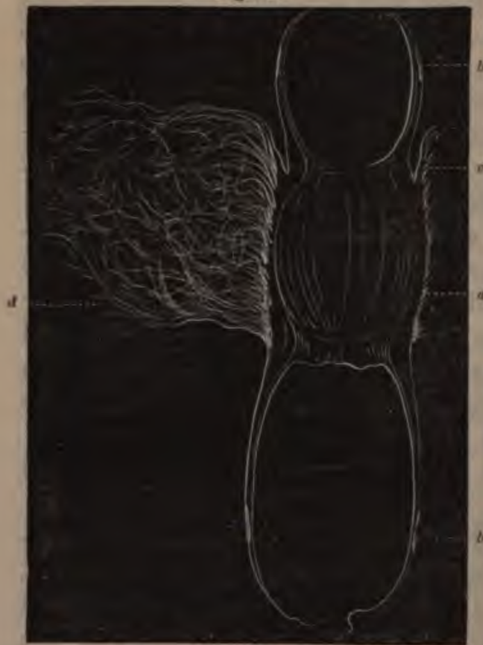
In January, 1864, Professor Jeffries Wyman communicated the results of his "Observations on the Development of *Raia batis*" to the American Academy of Science and Arts, and the article is printed in the Memoirs of the Academy for that year. These "Observations" contain all that is known relating to the development of the common skate of our coast, and should be read by every one interested in the subject.

Professor Wyman has granted me the use of the woodcuts illustrating his article, and rather than rewrite, abstract, and otherwise pilfer from his paper, I shall, with this acknowledgment, make extended quotations from his Memoir, and

add the explanations to the figures which he has so kindly placed at my disposal for this article.

"*Egg-case.*—This singular structure has the general form of such parts in egg-laying Selachians. The whole case, in the species here described is between six and seven inches in length, of a deep greenish-brown color, and composed of minute parallel filaments, which give it a striated appearance and a silky lustre. The central pouch (fig. 85, *a*), for the protection of the yelk and the embryo, is about two inches long, an inch and a half wide, bulges in the middle, and has a hollow, slender, curved horn projecting from each corner. The fore end of the pouch is deeply concave, and thickest, while the hinder is thin, nearly square, and ragged; it is from this part that the embryo escapes, after the separation of the upper and under walls from each other. The hinder horns project backwards as they lie in the oviduct, and are of about twice the length of those at the other end. The outer edge of each horn is the more rounded, and near the free end has an oblong slit (*b b'*) for the inward and outward flow of the water which passes through the egg during incubation.

Fig. 85.



Egg case of Skate, one-half natural size; *a*, pouch for the yolk; *b b'*, openings for the inward and outward flow of water; *c*, spur; *d*, membrane formed by the interweaving of the lateral filaments.

At the base of each fore horn is a slender projection or spur (*c*), about half an inch in length, the whole outer border of which breaks up into a series of silky filaments, and these are especially abundant near the free end. Similar filaments are given off from the whole border of the capsule, and all become tangled and woven together in such a manner as to form a broad and somewhat thick membrane on each side (*d*). This membrane was found entire only on cases taken from the oviduct, and on those newly laid. In all such, however, as have embryos somewhat advanced, it is more or less destroyed, and for the most part only tufts of it remain at the base of each horn. The

object of it is not apparent, unless it be to assist in securing an anchorage, by the entanglement of its filaments with submarine plants or rough surfaces.

In a single instance, in the dissection of skates, an imperfect egg-case was found in each oviduct, the development of it having just begun. The hinder horns and the hinder edge of the capsule were the only parts completed. They were contained in the glandular portion of the oviduct, which is quite thick during the reproductive season, and is mostly made up of very minute and slender follicles, of great length. From some of them fibrils protruded, identical in structure with those out of which the cases are made, and which, after being liberated, are doubtless moulded into the shape of these cases, and cemented together by some secretion from the oviduct. The horns are formed in grooves on either side of the duct, and the pouch for the yelk in the intervening space. A careful examination of the ovary and oviduct in the above instance showed the singular fact, that, although some of the yelks were mature, none had as yet been detached from the ovisacs. This circumstance renders it probable, that, after the horny pouch is partially formed, the yelk descends and enters it, and that then the other portions are completed. If this supposition, based upon a single observed instance, were to be confirmed by further examinations, it would prove the existence of an interesting deviation from a rule among animals generally supposed to be without exception, viz.: that the presence of the yelk in the oviduct is necessary before the formation of the egg-coverings can begin.

Fig. 86.

Eel-shaped embryo of Skate, connected with the yelk by a slender umbilical cord; *a*, omphalo-mesenteric artery; *c*, dorsal fins; *d*, anal fin.

Fig. 87.

Under side of the yelk of fig. 87, showing the continuation of the artery, *a*, and the connecting with the triangular terminal sinus.

In none of the cases which we have examined have we found the fœtus surrounded either by a membrane or by albuminous matter, but in every instance the yelk and the embryo were fully exposed to contact with the water, which entered by the openings already described. An albuminous covering may have existed at an earlier period, and have been absorbed."

"*Yelk.*—After the body of the embryo has become well defined, it is attached to the yelk by a slender umbilical cord about half an inch in length (fig. 86). The yelk has not the pyriform shape so common in other

Selachians, but is nearly spherical, though somewhat flattened above and below. The cord has the length just mentioned only temporarily, and soon begins to shorten, and contracts until the fœtus rests once more upon the surface of the yelk (figs. 91 and 93). The two omphalo-mesenteric vessels, common to all vertebrates, carry the blood from the embryo to the yelk and back. The artery, a branch of the mesenteric (figs 86 and 93, *a*), passes out beneath the head, over the front of the yelk, and descends to the under surface, giving off minute twigs to the right and left; but the trunk itself does not branch. Dr. John Davy, in his observations on the development of the torpedo, although he figures a vein surrounding the vascular area in the younger specimens, yet makes no reference to it in the text. Agassiz has observed a similar vessel in the yelk of a dog-fish, and has for the first time pointed out its resemblance to the *sinus terminalis* of birds. Dr. Davy's figures, taken in connection with those here given, form a complete series. In the youngest of the specimens described by him the sinus is found on the upper surface of the yelk, and quite near the embryo; in the second, it has receded towards the sides, and the vascular area enlarged to a corresponding degree. In our specimens it is found on the under surface, is of a triangular form (fig. 87), and encloses only a small area. Eventually it contracts still further, and at last wholly disappears, and thus the entire surface of the yelk becomes vascular (figs. 91 and 93).

Fig. 88.

Embryo of Skate, more advanced than fig. 86, a ventral view, showing the pectoral fins, *a*; the ventral fins, *b*; and the temporary anal fin, *d*.

As development advances the yelk is gradually withdrawn into the cavity of the abdomen, as in birds; but the retraction does not appear to be quite complete in the skates until a short time after hatching. In one instance a fully formed skate taken from the egg-case had the yelk reduced to a small flattened mass about two lines in diameter. Very nearly the same condition existed in another, which was already hatched. In a third instance, where the young had been hatched for a longer time, the yelk had been wholly introduced into the cavity of the abdomen; but a considerable mass of it, still within the abdominal cavity, remained to be absorbed (fig. 96, *a*), where, as in the newly hatched chick, it serves as a reservoir of nourishment. Dr. Davy states that, in the torpedo, the young fish is nourished by the yelk for six weeks after birth. In all cases we have found the vitelline duct entering the intestine just above the spiral valve."

"*Form of the Fœtus.*—The general form of the youngest specimen is long, slender, and gradually tapers to a point backward, as in fig. 86, and may be described in one word as eel-shaped. The head presents two rounded projections, one of them forward (figs. 89 and 90, *d*), forming the

foremost part of the embryo; this is made by the protrusion of the optic lobes, and closely resembles the same part in the embryos of birds; the second (fig. 90, *e*) is directed downward, and contains the cerebral and olfactory lobes behind which are the eyes. These last, which in the earlier stages, as in figs. 86, 88, 92, are on the same level with the surrounding parts, soon become remarkably prominent, as in fig. 94, where they remind us of the eyes of the young of Malleus.* In the fully formed fish they are again reduced to nearly the same level with the adjoining integuments. As development advances, the optic lobes cease to form the most prominent part of the head, in consequence of a change of position of the cerebral hemispheres, which rise to the same level with the organs just mentioned, as the facial disk (figs. 93, 95, 92, *b*) advances beneath them. In fig. 91 the embryo has many of the features of a shark; and in fig. 94, with the expansion of the pectoral and ventral fins, it begins to take on the form of the skate."

Fig. 89.

Head of fig. 88, enlarged, showing the first branchial arch *b*, without fringes; the mouth in open space between the first branchial arches; *d*, projection of the optic lobes; *e*, projection of the cerebral lobes.

"*Fins.*—In the youngest specimen examined (fig. 86), a vertical fold of skin stretches along the middle line, from near the head almost to the end of the tail above, and from near the umbilical cord to the same point below. These folds do not pass beyond or become connected around the end of the tail. The dorsals (figs. 86 and 93, *c*) are formed by two vertical extensions of the upper fold, and in this early stage of their existence are placed midway between the base of the tail and its tip, which last tapers to a slender point. The anals (figs. 86, 93, and 95, *d*) are formed from a similar extension of the under fold, and are situated somewhat further forward than are the dorsals. The first (fig. 91, *d*) grows very rapidly, and soon acquires a disproportionately large size; but the second (fig. 91, *d'*) is quite diminutive. Both upper and lower folds and fins have their edges bordered with follicles.

Fig. 90.

Side view of fig. 89, *a*, first branchial fissure, largest at its outer end, which portion corresponds with the future spiracle; *b*, the inner end; the first arch is in front of this fissure; *b'*, the second fissure, in front of which is the second arch, bearing a fringe; *c*, nasal fossa; *d*, projection of the optic lobes; *e*, cerebral lobes.

Both dorsal and anal fins undergo a very remarkable change as development advances. The first in the adult are found quite at the end of the tail, instead of the middle, as in the early stage. This change of relative position seems to be effected in part by the more rapid growth of that portion of the tail which is in front of them, while that which is behind scarcely increases in size, and thus

* Hammer-headed shark.

the fins are soon nearer the end than the middle. At the time of hatching, the terminal portion is still present (fig. 96, *c*); but subsequently it is either absorbed, or, what is not improbable, is covered by the extension of the dorsals backward.

The anal fins, the first of which, as already stated, attains to a remarkably large size, are gradually absorbed, and are wholly removed before the end of gestation. From the fact of these fins having a temporary existence in the skate, and a permanent one in many sharks, it is not improbable that they may be present in the embryos of all Plagiostomes.

Fig. 91.

Embryo of Skate at the Shark-shaped stage. *c*, the dorsal fins; *d*, *d'*, the anal fins.

This development, temporary existence, and early removal of the anal fins, gives us another interesting example of the formation of parts which have no obvious use in the economy, and which must be regarded as having merely a morphological value. It falls into the same category with the caudal fin of the embryo of Pipa,* which is never used, the teeth of certain Cetaceans, the inferior incisors of the female Mastodon, which are all removed without being used, and the milk incisors of the Guinea-pig, which are shed *in utero*.

There is still another point of interest in the morphology of the tail of the species we are here considering; for although symmetrical, it does not at any period assume the heterocercal form, but retains permanently its primary embryonic or protocereal condition.

Fig. 92.

Head of fig. 91, enlarged. *a*, nasal lobe; *b*, facial disk; *c*, upper lip.

In this respect the skates hold a lower position than the sharks, nearly all of whom pass through the protocereal into the heterocereal stage.

The pectoral and ventral fins begin as slight ridges on either side, but each soon takes on the form of a half oval disk (fig. 88, *a*, *b*). At first the two are nearly continuous in the same plane (fig. 88), but the pectorals (figs. 94 and 95, *a*) grow the most rapidly, gradually assume a somewhat oblique position, and in a short time partially cover the ventrals. None of the specimens were of a proper age to show whether or not the pectorals were formed first, as is the case with the fore limbs of all the vertebrates whose de-

*The singular Surinam Toad whose eggs are developed in cells formed on the back of the parent. — F. W. P.

velopment has been thus far studied. As they grow, they advance on either side of the head in the form of horns (figs. 94 and 95, a'), but by degrees the space between these horns and the side of the head is filled up, and thus the eyes and the persistent portion of the first branchial fissure are pushed to the upper surface, and eventually the pectorals gain the foremost part of the side of the head, at the same time becoming united with the extended facial disks.

The tail, as the whole animal increases in size, becomes relatively very much shorter. In the earlier stages the body is only three sixteenths of the entire length of the embryo, but subsequently it is about one half that length, as will be seen by a comparison of figs. 93, 94, 95, and 96."

"*Branchial Fissures and Gills.*—In nearly all adult Selachians there are five gill-openings in each side; Hexanchus and Heptanchus have respectively six and seven such openings. In addition to these, all of the skates and some of the sharks have a peculiar opening just behind the eyes, or

Fig. 93.

More advanced embryo of Skate, having passed through the Eel and Shark-shaped stages and commencing to assume the characteristic form of the adult. *a*, artery; *b*, facial disk; *c*, dorsal fins; *d*, anal fin.

at some point between these and the first branchial fissure, which makes a direct communication, for the most part of a large size, between the top of the head and the pharynx, and to which the terms 'spiracle,' 'event,' 'Spritz-locher,' 'foramina temporalia,' etc., have been applied.

In the youngest embryos of skates here described, we have found the number of gill-openings or branchial fissures seven on each side, all well defined except the last, which is the smallest of the series (figs. 88 and 89). These are all in the same range from before backward, and at this stage the spiracle, as such, is not distinguished from the others. It is characteristic of the early embryos of all Selachians, to have developed, in connection with branchial apparatus, temporary gills which are seen in the form of long and slender filaments projecting from the sides of the neck. They are generally described as coming out through the gill-openings, and as prolongations of the internal gills. Cornalia, who has made a special study of these organs, so describes and figures them. We believe that, in consequence of not having seen embryos sufficiently young, he has been led into an error.

We have found them when first formed, growing from the outer edge of the branchial arch (figs. 89 and 90), and at that time in no way connected with the branchial fissures. In the skate, the first and seventh arch had no fringes at any period, and of the five which had them, the fringes of the foremost ones were the longest, the hindmost being merely short, conical projections. As development advances, the bases of the fringes are gradually covered up, as it seems, by the growth of the portion of each arch in front of them, which is thus projected outward as the body becomes thicker from side to side; the line of attachment of the fringe, which retains its original position, being thus buried between two adjoining arches.

Fig. 94.

Fig. 95.

Dorsal and ventral views of fig. 93. *a*, *a'*, pectoral fins; *b*, facial disk; *c*, ventral fins; *d*, anal fin; *d'*, dorsal fins; *e*, gill fringes.

From the fact that the temporary gills are formed before the permanent ones, and from the outer surface of the arch, it is obvious that they cannot be—as commonly described—prolongations of these last-mentioned breathing organs.

The fringes do not cover the whole border of the arch, but are confined to its central portion, and consist of from six to eight filaments each.

We have made no observations on the formation of the internal gills, and cannot therefore explain the connection which eventually exists between these and the fringes, and which at a later period correspond exactly with the descriptions usually given.

The existence of temporary branchial fringes, and their subsequent absorption, is one of the most remarkable characteristics of Selachians, and one in which they differ from all osseous fishes, unless it be the Lepidosiren. All vertebrates, as embryos, agree in this, that they are in their early stages provided with "branchial fissures" and "arches" or, as they sometimes have been called 'visceral' arches. Gills or gill fringes, either as temporary or permanent structures, are never formed in any scaly reptile, bird, or mammal. Much confusion and misapprehension have arisen from the constant reiteration of the opinion put forth in the early days of embryology, that all vertebrates at one time have a branchial respiration, an error which is repeated by naturalists even at the present day. Among Batrachians some genera, as Menobranchus, Siren, etc., have external

fringes permanently attached to their branchial arches, which are not known to be replaced by, or to coexist with, internal gills. They are their sole organs of respiration, for their lungs are too imperfect and rudimentary to have much physiological importance. In frogs, toads, and salamanders, the external gills are replaced by internal ones, and these in turn by lungs. Thus it will be seen that no Batrachian is permanently provided with internal gills.

Selachians and Batrachians agree in this, that their embryos have in their first stages external fringes growing from the outer surface of the gill arches, and these fringes have the same structure in both. The Selachians still further agree with frogs, toads, and salamanders, in the fact that the outer fringes are absorbed, and are replaced by internal gills. They differ from them, however, in the following particular. Selachians retain their internal gills permanently through life, while, if such exist at all in the Batrachians just mentioned, it is only during the larval stage, and they are soon replaced by lungs. Selachians may therefore be said to pass through stages analogous to the first and second stages of Anourous Batrachians and salamanders.

Fig. 96.

Newly-hatched Skate; *a*, yelk-sack in the cavity of the abdomen, connecting with the intestine, *b*; *c*, embryonic portion of the tail which disappears in the adult, and corresponds with the portion of the tail behind the dorsal fins in the figures representing still younger stages; *d*, upper lip; *e*, developed facial disk.

The other changes which the fissures pass through before the skate acquires its permanent form are as follows. The seventh fissure is closed up at a very early period, about the time that the dorsals are beginning to be formed. While the first arch bends and is drawn forward as already described in connection with the formation of the jaws, it at the same time becomes broader, so as to widen the distance between the mouth and the first fissure, or the second, after the first is partially closed.

The inner part of the first closes up, while the outer remains open (fig. 90, *a*), is somewhat enlarged, and retains its relative position to the eye. It is very soon widely separated from the other fissures by the rapid growth of the intervening parts, and still further by the extension of the pectoral fins forward between this remnant of the first fissure and those behind it, the former being thus thrown to the upper, and the latter to the under surface. The unclosed portion of the first branchial fissure is thus converted into the spiracle.

The transformation thus described is of very great interest when compared with the changes which occur in the corresponding fissures of the air-breathing vertebrates, and enables us to establish an unexpected homology. Reichert, in his most important investigations of the development of the gill arches ('visceral Bogen') of the pig, has shown that in this animal the first fissure is gradually separated from the others by the widening of the second arch, and for a time, even after all the others are closed up, forms a direct opening from the side of the neck into the pharynx. Afterwards it is divided into an outer and inner portion by a membranous septum; the former being the external auditory canal and the latter the Eustachian tube and the cavity of the tympanum. It will thus be seen that the spiracle is not only a true branchial fissure in the first place, but that in the end it is homologous with the Eustachian tube and the outer auditory passage before these are separated from each other by the membrane of the tympanum.

Professor Huxley, in a series of lectures on the Vertebrate Skeleton, in which the homologies and development of it are discussed with great ability, sets forth a somewhat different view with regard to the formation of the external ear, and maintains that the first step is similar to that in the case of the eyes and nose, viz.: an "involution" or a "pushing in" of the integument. Professor Huxley's observations were made on the chick, and he arrives at the same conclusions as Remak, leaving us to infer that the auditory passage and Eustachian tube have no connection with the branchial fissures. We have gone over the same ground in the pig, and have found Reichert's observations, as mentioned above, fully confirmed.

The relation of the spiracle to the branchial fissures is still further shown by the fact that in some species, as in Scyllium and Læmargus, it, like the others, is provided with respiratory fringes. In the skate this is not the case, but in the adult a comb-like fold, resembling, and probably having the functions of, a gill, is found just within the spiracular opening."

For a description of the development of the mouth and nostrils, and some other details which have been omitted in these extended quotations, the reader is referred to Professor Wyman's Memoir.

NOTES ON SOME OF THE RARER BIRDS OF MASSACHUSETTS.

BY J. A. ALLEN.

(Continued from page 585.

BAIRD'S SPARROW. *Centronyx Bairdii* Baird. Mr. C. J. Maynard while collecting Long-spurs and Snow Buntings on the Ipswich sand-hills, December 4th, 1868, had the good fortune to shoot the first specimen* of this species thus far obtained east of the Missouri, so far as known. No other at least is yet on record, and but one other specimen seems to be extant. This is one of Audubon's types collected near the mouth of the Yellowstone, in the summer of 1843, and now in the Museum of the Smithsonian Institution. Mr. Audubon is the only naturalist who has previously met with it. He reports it as common at the locality where he discovered it, where he obtained both males and females and its nest.† But very little is known respecting its migrations or its distribution. Its discovery in Massachusetts was quite unlooked for. Mr. Maynard thinks he saw others, but supposing it to be some other species he made no especial efforts to obtain them. In his notes kindly communicated to me he remarks: "I saw other specimens, and am confident that I detected it the preceding season, 1867. It is probable that it is a regular winter visitor from the north, accompanying the *C. Lapponicus* and *P. nivalis*, for it does not seem probable that it should occur regularly so far from its usual habitat—the distance being some over sixteen hundred miles—and not be found in the intermediate space." As he further observes, his specimen somewhat resembles the Bay-winged Sparrow (*Poocœtes gramineus*), with which inexperienced ornithologists might easily confound it. It is

* Mr. Maynard gives a good figure of this specimen in his book on Taxidermy ("Guide to Naturalists in Collecting and Preserving Objects of Natural History") now publishing.

† Birds of America, Vol. vii, p. 359, pl. 500.

certainly nearer this than the Savannah Sparrow, with which it has been compared. "My specimen," he says, "also differs in size [from Audubon's*]. I give measurements of both for comparison, remarking that mine was measured from the fresh bird, while the other was from the skin."

LOCALITY.	Date.	Length.	Alar ext.	Wing.	Tail.	Bill.	Tarsus.	Sex.
Mouth of Yellowstone.	1843	4.64	——	2.77	2.10	.39	.84	–
Ipswich, Mass., ...	Dec. 4, 1868.	6.30	11.00	3.25	2.60	.40	.95	♂

It differed in color as well as in size from the specimen described by Prof. Baird. The former difference is doubtless due to the different seasons of the year at which they were collected, and the latter to the fact of the Ipswich specimen having a more northern birth-place. That there might be no mistake, the specimen was transmitted to Professor Baird for examination, who kindly compared it with the type in the Smithsonian Institution, and reports that he found them identical.

SAVANNAH SPARROW. *Passerculus savanna* Bon. Rather rare in the interior at all seasons, and, so far as I can learn, only seen there during its migrations. On the coast, however, it is one of the most common sparrows throughout the summer, where great numbers breed. I have seen it from Ipswich southward all along the coast to Nantucket Island. On the islands off the coast it is often the most numerous species of bird. The Song Sparrow, on the contrary, is more numerous in the interior, it being comparatively scarce on the islands and on the coast close to the sea.

HENSLOW'S SPARROW. *Coturniculus Henslowii* Bon. This species must still be considered a rare summer visitor, though it proves to be more common than was supposed a few years since. Specimens are taken in the eastern part of the state nearly every year, where also several of its nests

* See Baird's Birds of North America, p. 441.

have been found. The first nest found in this state was discovered by Mr. E. S. Wheeler, in Berlin, and the fact is recorded in the seventh volume of the Proceedings of the Boston Society of Natural History (page 137). This species was at first wrongly identified as *Peucea Backmanii* Aud (=*P. æstivalis* Baird), and as such stands recorded in the sixth volume of the same Proceedings (p. 21). The mistake was corrected, however, on p. 74 of the same volume, so that *Peucea æstivalis* has never been included nor referred to as a bird of Massachusetts in any of the lists of the birds of the state, or of New England.

In respect to *C. Henslowii*, Mr. Maynard informs me it has been confounded with *C. passerinus* by a number of collectors, and that it seems to be more common at some localities in the state than the latter.

WHITE-CROWNED SPARROW. *Zonotrichia leucophrys* Sw. Rare in all parts of the state, and thus far not known to breed in Massachusetts, though it may do so among the mountains in the western counties. Though mentioned by Dr. Coues as "usually common, but of somewhat irregular occurrence" in New England,* the score or more of collectors with whom I am acquainted all look upon it as one of our rarest species in Massachusetts. Some have never met with it. More to the westward, however, it is quite common. In Wayne county, New York, I found it as numerous in May, 1867, as the White-throated Sparrows usually are in New England.

WHITE-THROATED SPARROW. *Zonotrichia albicollis* Bon. A pair of these birds, probably the same pair, has been observed by Mr. R. B. Hildreth at Springfield during the last three summers. Though he has not succeeded in discovering their nest, he this year observed them feeding their scarcely fledged young. He reports that they have become very familiar and readily answer his call. Though breeding nu-

* List of the Birds of New England, l. c. p. 282.

merously in Northern New England, Springfield is considerably south of their customary breeding range.

SHARP-TAILED FINCH. *Ammodromus caudacutus* Swain. Some half a dozen nests and as many pairs of the birds were obtained the present year, by Mr. H. W. Henshaw in the Charles River marshes in Cambridge. These are the only recent instances known to me of the finding of the nest of this species in Massachusetts. None of the Seaside Finches were observed, though they were formerly known to breed in the Chelsea marshes, and probably do still.

TREE SPARROW. *Spizella monticola* Baird. I mentioned in my Catalogue that a nest of this species was found in this state in 1855 by Mr. E. Samuels, there being a record to that effect in the fifth volume of the Proceedings of the Boston Society of Natural History (p. 213). I have since learned from Mr. E. A. Samuels that this was a case of malidentification, the nest and eggs being really those of the Chipping Sparrow (*Spizella socialis*). Dr. Brewer confirms the latter account, and says he has the nest in his possession.

LINCOLN'S SPARROW. *Melospiza Lincolnii* Baird. The first record of the occurrence of this species in Massachusetts is given in my Catalogue, at which time I had taken three specimens at Springfield. It has since been taken by Mr. S. Jillson, at Hudson,—one specimen in May, 1867, and another in May, 1868. In 1867 I took it in May in Wayne County, N. Y., when it appeared to be not uncommon, and in Northern Illinois the same year I found it numerous.

SWAMP SPARROW. *Melospiza palustris* Baird. In the "Addenda" to Dr. Coues' "List of the Birds of New England" I stated I had never met with this species in the breeding season. I have since learned that it is not at all uncommon at that season at several localities in the eastern part of the state; some years it breeds quite numerously in the Fresh Pond marshes.

BLACK-THROATED BUNTING. *Euspiza Americana* Bon. Since the publication of my Catalogue, Mr. C. W. Bennett

has taken this species at Holyoke,—a single specimen in May, 1866. Dr. Brewer informs me he has found it breeding at Hingham. The species is still known, however, as only a straggler from the southward.

CARDINAL. RED BIRD. *Cardinalis Virginianus* Bon. Four specimens of this bird were taken near Springfield in October, 1866. Mr. W. H. Niles observed it at Belchertown the last week of October, 1868, and at Southampton May 5th, 1869. As these form all the recent authentic instances of its occurrence in the state, it can only be regarded as an accidental visitor. It has been questioned whether in the previous instances of its capture here the specimens taken were not birds that had escaped from cages. In all probability they were, however, wild birds.

EUROPEAN HOUSE SPARROW. *Passer domestica* Leach. The few pairs turned loose in the Boston Common a few years since seem to be slowly increasing in numbers, and bid fair to be of great service in checking the ravages of several species of caterpillars that now greatly injure the foliage of the shade trees. These interesting birds are now frequently observable both on the Common and in the Public Garden.

EUROPEAN GOLDFINCH. *Carduelis elegans* Steph. February 28th, 1865, I saw a single male on Quincy street, Cambridge, that had probably escaped from a cage. It was feeding on the seeds of the larch and appeared fully at home. Its notes first drew my attention to it, which, while so much resembling those of our common Yellow Bird, yet differ from them in surpassing in sweetness the pleasant warble of that favorite bird. I doubt not that if a considerable number of European Goldfinches should be introduced into New England the species would soon become acclimated and generally distributed.

SERIN FINCH. *Serinus meridionalis* Brehm. A specimen of this European species was taken near Springfield in November, several years since. It may have been a cage bird that had escaped.

Yellow-headed Blackbird. *Xanthocephalus icterocephalus* Baird. The wings, tail and feet, of a specimen of this species taken in Watertown, in October, 1869, were shown me a few weeks since by Mr. C. J. Maynard. Although the whole bird was unfortunately not preserved, its identity could be readily determined. This is the first known instance of the occurrence of this species in New England, but Mr. Cassin* states that several have to his knowledge been taken near Philadelphia. Its usual eastern range, as ornithologists well know, is the vicinity of Chicago, it being essentially a prairie species.

Boat-tailed Grackle. *Quiscalus major* Vieill. I now seriously question the occurrence of this southern species in Massachusetts, or anywhere in New England, as even an accidental visitor. I gave it as such in my Catalogue, but a reëxamination of the evidence has led me to my present opinion. I think the cases cited by Peabody† and Linsley‡ (under *Q. baritus*) as well as that of Mr. Samuels, refer only to the common Crow Blackbird or Purple Grackle.

Spruce Partridge. *Canace Canadensis* Bon. The occurrence of this northern species in the hemlock woods of Gloucester in 1851 was recorded by Mr. F. W. Putnam.‖ This instance is cited in my own Catalogue, and by Dr. Coues in his "List of the Birds of New England." A second instance is to be now added, as I have learned from Mr. S. C. Martin that a bird of this species was shot in November, a few years since, in Roxbury. These two instances seem to be all thus far known, and only give it a place on our list as a very rare, accidental visitor. I have, however, recently learned from Mr. Wm. Brewster, of its capture near Portland, Maine, in the autumn of 1868,—a locality much south of its usual range.

* Proc. Phila. Acad. Nat. Sci., Vol. xviii, p. 11, 1866.
† Rep. on Orn. Mass., p. 285.
‡ Amer. Journ. Sci. and Arts, Vol. xliv, p. 260.
‖ Catalogue "Birds of Essex Co.," Proc'd's Essex Inst., Vol. i, p. 224.

The Ptarmigan (*Lagopus albus*), captured at Manchester in May, 1859,* is supposed, Dr. Coues states, "to have been brought alive from Labrador or Newfoundland, and escaped."†

GREAT WHITE HERON. *Herodias egretta* Gray. To the previously recorded instances of the capture of this beautiful southern Egret in this state may be added the following. Two immature specimens were taken near Hudson by Mr. S. Jillson in 1867, and several others seen there. A fully plumaged male was also taken in Ashland in May several years since by Mr. A. L. Babcock, and another near Lynn, by Mr. N. Vickary. New Jersey seems to be the most northern point on the Atlantic coast where these birds breed, or at which they can be considered as regular visitors, yet this species, as well as the Snowy Heron (*Garzetta candidissima*), have recently been captured in Nova Scotia.‡

LITTLE BLUE HERON. *Florida cœrulea* Baird. In addition to the previously recorded instances of its occurrence in Massachusetts, Mr. Maynard informs me he has recently seen it on one or two occasions in autumn.

YELLOW-CROWNED NIGHT HERON. *Nyctherodius violaceus* Reich. Mr. N. Vickary, of Lynn, the well known taxidermist, informs me that in October, 1862, he shot a fine specimen of this bird in Lynn. Though occurring occasionally as far north along the coast as New York, I have learned of no other instance of its capture in New England.

GLOSSY IBIS. *Ibis Ordii* Bon. In addition to those previously recorded as having been captured in Massachusetts, a specimen was taken in Nantucket, September, 1869. It was also taken, as I learn from Mr. N. Vickary, in New Hampshire, in October, 1858, by Dr. Palmer.

WILSON'S PLOVER. *Ochthodromus Wilsonius* Reich. The usual northern limit reached by this bird seems to be the

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* F. W. Putnam, Proc. Essex Inst., Vol. ii, p. 378.
† Ibid., Vol v, p. 289.
‡ J. Matthew Jones, Trans. Nova Scotia Inst. Nat. Sci., Vol. ii, pt. 2, p. 72 (1868).

coast of New Jersey, where it is said to breed.* In my Catalogue I inserted it as a bird of this state on the authority of Dr. Brewer, who, according to Mr. Peabody, found them abundant at Nahant in August, 1838. But Dr. Brewer wrote me under date of May 8th, 1869, that "Wilson's Plover is *not* a Massachusetts bird, so far as I know." Dr. Wood informs me that "Wilson's Plover is abundant in August on Long Island," and Mr. Linsley has recorded it from Stratford, Connecticut. It hence seems unquestionable that they sometimes occur in Southern New England, and it would not be strange if they should occasionally reach the coast of Massachusetts.†

BLACK-NECKED STILT. *Himantopus nigricollis* Vieill. Mr. G. A. Boardman informs me that he once saw two specimens of this species in Boston Market that were killed in this state. I have also learned from Mr. Maynard that it is well known to the gunners of Ipswich, who occasionally meet with it, and by whom it is ironically named "Humility." It appears to be, however, one of the rarest of our visitors, it being properly a southern and south-western species.

SANDERLING. *Calidris arenaria* Illiger. A few specimens of this species and of the Semipalmated Sandpiper (*Ereunetes pusillus* Cass.), and the Solitary Sandpiper (*Rhyacophilus solitarius* Baird), were taken by Mr. Maynard and myself at Ipswich in June, 1868. The last mentioned may have been breeding, as the Massachusetts coast is within its usual breeding range, but the others appeared to be only stragglers that were not breeding, all, apparently, being immature birds. The first of these is well known to breed on the coast of Maine, where Prof. Verrill gives it as abundant in summer. In some notes hastily penned for Dr. Coues' "Addenda" to his "List of the Birds of New England," written from memory (at the time of writing them I was on

* Dr. C. C. Abbott, Geology of New Jersey, Appendix.

† Compare with this Dr. Coues' remarks on this species in his "List of the Birds of New England," l. c., p. 291.

a journey and my notes were inaccessible), I state that *Actodromas Bonapartei* was among the birds seen by us in summer on the Massachusetts coast. This I think is an error of memory, as I do not find it recorded in my note book, and no specimens of it were taken. *Arquatella maritima* is also there mentioned as having been *seen;* though this is probable, I should add that it does not rest on positive evidence, as none were taken.

STILT SANDPIPER. *Micropalama himantopus* Baird. As this southern species has been twice taken recently at Rye Beach, New Hampshire, by Mr. William Brewster, the question as to whether it should be included among the birds of New England is now settled. As it must have passed through Massachusetts, it is properly to be included in our list, though not yet recorded as actually taken in this state.

YELLOW RAIL. *Porzana Novæboracensis* Cass. Taken by Mr. C. J. Maynard, September 8th, 1868, in a dry field in Newton.

COMMON GALLINULE. *Gallinula galeata* Bon. I learn from Mr. Ruthford Deane of Cambridge that he shot a young bird of this species in Fresh Pond on the 3d of September, 1868, and saw two others in the latter part of the same month. The 9th of October of the same year he informs me his friend William Brewster shot one which he obtained, and wounded another, at the same locality. Also that the latter observer saw an old bird there on the 3d of June, which Mr. Deane believes to have been the parent of these young. As this species regularly breeds in New Jersey, it is not improbable that straggling pairs may now and then rear their young in Massachusetts, but this is much beyond its usual breeding range.

CANVAS-BACKED DUCK. *Aythya vallisneria* Bonap. It is stated in my Catalogue that this species was taken near Springfield by Dr. Wood. This proves to be an error, as Dr. Wood has since informed me he never knew it taken nearer that locality than ten miles above the mouth of the

Connecticut. So far as I have been able to learn by careful inquiry, this species is much less common in New England than several authors represent. It seems to be but an accidental or very rare visitor.

AMERICAN WHITE PELICAN. *Pelecanus erythrorhynchus* Gmelin. I learn from Mr. S. C. Martin that a flock of thirteen individuals visited Nantucket Island during a heavy storm a few years since. After being repeatedly fired at one of them was finally killed, near Brant Point light-house. Mr. C. J. Maynard also informs me that several were seen at Ipswich at about the same time. The only other recent instance of the capture of this species in New England seems to be that at Calais, Maine, given by Mr. G. A. Boardman.* It seems to be entirely accidental here now, although formerly, according to early writers, of not unfrequent occurrence. It still ranges, however, over the greater part of the continent.

HERRING GULL. *Larus argentatus* Brünn. Although large numbers of this species spend the summer along the Massachusetts coast, I have not been able to find any breeding here. Those seen in summer are all immature birds, generally in brown plumage. Although they once unquestionably bred on our coast, none now appear to rear their young nearer than the northern part of the coast of Maine. Hence the occurrence of large numbers of immature birds in summer two hundred miles south of the nearest breeding grounds of the species is a fact of considerable interest.

Some years since Dr. Elliott Coues separated the American Herring Gull from the European, under the name of *Larus Smithsonianus*, he supposing it to differ in certain points of coloration from the European bird.† Unfortunately, these differences do not prove constant, specimens identical in every particular with the typical European *L. argentatus* of Coues occurring not unfrequently on the New

* Proc. Bost. Soc. Nat. Hist., Vol. ix, p. 130.
† Revision of the Gulls of North America, etc., Proc. P. A. N. S., June, 1862, p. 296.

England coast. As I have already called attention to this fact* I will only add that during last winter additional specimens of this character were obtained by me in Cambridge.

LAUGHING GULL. *Chrœcocephalus atricilla* Lawr. This bird now breeds on the Massachusetts coast very sparingly, it having been nearly extirpated by the incessant persecution it suffers from "eggers" during the breeding season. A few pairs were observed last year on Muskeget Island, by Mr. Maynard and myself, and a few of its eggs obtained, about July 1st. As they had previously been repeatedly robbed, "eggers" almost constantly haunting the island, they were extremely shy. Another small colony of this species, I have learned from Mr. L. L. Thaxter, breed on the islands near Tennant's Harbor, Maine.

In my Catalogue I by some mistake gave this bird as occurring in *winter*. Though said by Mr. Boardman to be resident in the vicinity of Calais, Maine, I have as yet been unable to learn of its occurrence in this state except in summer. My earlier impression that the species was resident in Massachusetts I have since found was wrongly founded.

COMMON TERN. *Sterna hirundo* Linn. This interesting bird must soon be numbered among the species which persecution has driven from the state during the breeding season, unless some effective mode of protecting it during the breeding season is soon adopted. At present it is only found at a few localities, chiefly on Muskeget and the neighboring islets; a few only breed at different points along Cape Cod and at Ipswich. Almost everywhere they are more or less persecuted, and at Muskeget this and the other species of Terns that breed there are so systematically robbed of their eggs that if they succeed in rearing any young at all it is only after having been several times deprived of their eggs. Muskeget is a small, barren, sandy, crescent-shaped island, about two miles in length, with, in its wider part, a breadth

* Memoirs Bost. Soc. Nat. Hist., Vol. i, p. 520.

of about half a mile. Only thinly clothed with beach grass, it is naturally well suited to the breeding habits of the several species of Terns that regularly resort to it to breed. Though uninhabited by man and quite distant from large towns, the birds are far from secure there. Besides the daily visits of small egging parties during the proper season from Nantucket and other near points, excursions are made by large parties from distant places to the island for the express purpose of participating in the novelty of an egg hunt, with sad results to the birds, as above stated. This is certainly a matter that the "Society for the Prevention of Cruelty to Animals" should look after.

ARCTIC TERN. *Sterna macroura* Naum. In company with the preceding are found a certain proportion of these birds. Last year Mr. Maynard and myself found them breeding apart from the others on the island of Muskeget. We also found them at Ipswich, as Mr. Maynard has also done the present year. In voice and habits, however, the two seem not to differ in the slightest, nor in general size. In color they only differ as young birds often do from older ones of the same species, the *S. macroura* corresponding to the mature form and the *S. hirundo* to the younger. The tarsi and the bill in *S. macroura* seemed to be generally the shorter, but not always. In color *S. macroura* was always the brighter, without the black tip of the bill seen in *S. hirundo*; the black on the head is generally, more intense and better defined; the sooty wash beneath is much deeper, and the white of the rump purer. The tarsus was not only shorter but had a roughened appearance not seen in the other, they differing in the latter respect much as young birds in this and allied families frequently do from those perfectly mature. On the whole there seemed to be good reasons for believing them to be simply different ages of the same species. The young of *S. macroura* being then unknown, it was evident that the discovery of them would afford decisive evidence on the point in question. Fortunately this

year Mr. Maynard succeeded in obtaining the young of *S. macroura* at Ipswich, when they were just able to leave the nest. A comparison of these with the young of *S. hirundo* of corresponding age, or even with mature *S. hirundo*, leaves no question as to their distinctness. The differences between the young of the two are as great as between the adult. In these nestlings of *S. macroura* the color of the rump is as different from that of the back as it is in the adult, the plumbeous bluish mantle not being continued to the tail as in *S. hirundo*.

The distinctive differences then between them may be stated thus:

S. macroura has the under parts strongly tinged with plumbeous, with the throat and under tail coverts abruptly white, while in *S. hirundo* the under parts are faintly washed with plumbeous which fades gradually into white on the throat and under tail coverts. *S. macroura* has the shorter tarsi, and the shorter, smaller and more delicately shaped bill; in color the bill of the latter is uniformly carmine, not coral red with a black tip, as in the other, and the tarsi and feet deep vermilion, almost lake (not light vermilion as in *S. hirundo*), and roughened. The rump is abruptly white at all ages, while in *S. hirundo* it is dilute plumbeous, shading gradually into the color of the back. In size and general proportions there are no essential differences between them.

So long as the young of *S. macroura* was unknown, it seemed that the differences in color between the young of *S. hirundo* and the adult of that species, if carried a little further, would result in a form, so far as color is concerned, exactly like *S. macroura*.*

Roseate Tern. *Sterna paradisea* Brünn. Occurs plentifully on Muskeget Island during the breeding season. Was also taken by Mr. Maynard and myself at Ipswich in June,

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* For an excellent revision of the Terns of North America, see Dr. Elliott Coues' paper on this subject in the Proceedings of the Philadelphia Academy of Natural Sciences, 1862, p. 535.

1868. Heretofore generally considered rare in this state, which appears to be its northern limit.

SANDWICH TERN. *Sterna cantiaca* Gmelin. (*Sterna acuflavida* Cabot.) Mr. Nathaniel Vickary, of Lynn, has a specimen of this species in his collection, which he shot at Chatham, in August, 1865. The usual northward range of this southern species does not extend beyond South Carolina, and is now for the first time reported as captured either in this state or in New England.

SHORT-TAILED TERN. *Hydrochelidon fissipes* Gray. Occasional, chiefly after the breeding season. Mr. C. J. Maynard has taken it at Ipswich, and probably it occurs all along the coast, though its existence here has been questioned.

SOOTY TERN. *Haliplana fuliginosa* Wagl. (*Sterna fuliginosa* Gm.) This species was given in my list as a rare summer visitor, on the authority of Mr. E. A. Samuels, who —he having found two young birds he referred to this species—informed me that it bred on Muskeget Island. As it is a southern species, and is only occasional on the coast of New Jersey, which is north of its breeding range, it is somewhat doubtful whether it is entitled to a place in a list of the birds of Massachusetts. Respecting this species Dr. Brewer has written me as follows: "It does not and never did breed on Muskeget, nor do I believe it ever comes here." Since the equally southern Sandwich Tern has been taken here, the probability of this being also an accidental visitor is increased.

GREAT AUK. *Alca impennis* Linn. This species has recently been made known as a former inhabitant of Massachusetts. Professor Wyman first discovered its remains in New England at Mount Desert, in the Indian shell-heaps.* Mr. F. W. Putnam reports that a humerus of this bird was found in August, 1868, in the shell-heaps of Ipswich, by Professor Baird.† Mr. Maynard and myself found frag-

* American Naturalist, Vol. i, p. 578.

† Coues' "Birds of New England," Proc. Essex Inst., Vol. v, p. 310, foot note.

ments of several different bones of this bird in June of the same year at the latter locality, where also Mr. Maynard had obtained them in previous years.

It appears, from information received too late to enable me to insert them in their proper places, that the following species should also be added to those already recorded from Massachusetts:

SWALLOW-TAILED HAWK. *Nauclerus furcatus* Vigors. From Mr. Bennett I have received a description of a hawk seen near Whately, not long since, that was unquestionably of this species; but, so far as I am aware, it has not yet been taken in Massachusetts. Although a southern species, it is rather common in the interior as far north as Iowa, and stragglers have been taken along the Atlantic coast as far north as New York. It can only occur in New England, however, as an extremely rare visitor.

A South American Humming Bird, *Argytria maculata* Cab. and Heine, was taken in Cambridge in August, 1865, by Mr. Wm. Brewster. It seems almost incredible that so small a bird should wander so far from its usual haunts, since its real habitat is the northern countries of South America; yet after carefully investigating the history of this specimen, it seems to me there is no reason to doubt its capture in this state. It is possible, of course, that it may have been brought here in a cage and have escaped, but that such was the case does not appear to be at all probable.

GRAY KING BIRD. *Tyrannus Dominicencis* Rich. A specimen of this species, now in Mr. Vickary's collection, was shot in Lynn, early in October, 1869, by Mr. Charles I. Goodale. Although essentially a West Indian species, it is not uncommon in Florida, but only occasionally ranges so far north as Charleston, South Carolina. It hence forms one of the most remarkable additions to the fauna of the state yet recorded. The specimen was evidently a young bird, or a bird of the year.

The following facts also came to hand too late to be inserted in their proper connection:

Black Vulture. *Cathartes atratus* Less. Mr. S. Jillson informs me that a specimen of this species was killed in Hudson a short time since, and that several others were seen there which no one cared to shoot. Mr. G. A. Boardman has also recently taken it near Calais, Maine.* Though rather more southern in its distribution than its near relative the Turkey Buzzard (*C. aura*), it seems to be much more frequently met with in New England, and has been taken as far north as Nova Scotia.

Barn Owl. *Strix pratincola* Bon. A specimen of this species, Mr. Vickary informs me, was taken in Lynn six years since, by Mr. James Teal, and is still in a private collection in that town. This forms the second specimen of this species thus far known to have been taken in Massachusetts.

Tengmalm's Owl. *Nyctale Tengmalmii* Bon. Mr. Vickary has a specimen of this rare winter visitor that he informs me was shot in Lynn, in 1863, by Mr. J. Southwick. I have also seen two other specimens of this bird that have been recently killed in this state.

This is the species referred to in my Catalogue as Richardson's Owl (*Nyctale Richardsonii* Bon.), which is the name of late generally given to it by American authors. It does not, however, upon comparison, appear to be distinct from the so-called Tengmalm's Owl of Europe, with which, previous to 1838, it was by all writers considered to be identical.

From information received since the first part of this paper went to press, several species whose occurrence in Massachusetts was unknown to the writer at that time (two of them having been for the first time captured here since that part of the paper was written) have been added to the

* See American Naturalist, Vol. iii, p. 498, November, 1869.

Massachusetts fauna, so that a revision of a portion of that part is already necessary.* The whole number of species is now three hundred and eight, or—excluding the House Sparrow (*Passer domestica*), which has been introduced by man, the Goldfinch (*Carduelis elegans*), the Serin Finch (*Serinus meridionalis*), and the South American Humming Bird, which may also have been (but probably were not) similarly introduced—three hundred and five, instead of three hundred, as there stated, or two hundred and ninety-six, as given in my Catalogue. Three of the species recorded in the Catalogue being now no longer counted, the whole number of species of birds added to the fauna of the state since 1864 is sixteen; eleven, and probably fifteen, of which can unquestionably be legitimately counted.

In this connection it may be asked, in view of the numerous recent additions to the bird fauna of this state: Are not certain species that were formerly regarded as scarce here now increasing in numbers? and is it not probable that some of the species recently detected have but recently made their first appearance here?

It is probable that a few species have recently increased and still are increasing in numbers; but it seems more probable that in most cases this apparent increase is more the result of the much greater number of observers now in the field than formerly, and the consequently much greater amount of attention recently given to the ornithology of our state. Doubtless other species will soon be detected here.

The occurrence of several species in Massachusetts whose

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* The following corrections should be made in the first two parts of this article:—Page 512, last line, for *seven* read *twelve*. Page 512, add to the second foot note, *Buteo Cooperi*, *Tyrannus Dominicensis*, *Xanthocephalus icterocephalus*, *Nyctherodius violaceus*, *Sterna cantiaca*. Page 513, change the sentence beginning in the ninth line to read as follows: Others now added, especially the California Hawk (*Buteo Cooperi*). Baird's Finch (*Centronyx Bairdii*), and the Gray King Bird (*Tyrannus Dominicensis*), are simillar and equally remarkable cases of western and southern species straggling far beyond their usual range. Page 513, 19th line, for *specimens* read *species*. Page 513, 25th line, for *three hundred* read *three hundred and fifteen*. Page 516, 1st line, for 1862 read 1861. Page 518, 12th line, for *characteristic* read *well-marked*. Page 582, 10th line, for *frontalis* read *Californicus*. Page 583, 16th line, for *epilipes* read *exilipes*. Page 584, 2d line from bottom, for *have* read *had*. Page 585, 8th line, dele *of*.

usual range does not extend much to the eastward of the Mississippi River, and of two not usually found east of the Rocky Mountains, and of others that rarely occur north of Florida, shows the possibility of a species becoming widely diffused over districts favorable to its existence by occasional migrations.

OUR COMMON FRESH-WATER SHELLS.

BY EDWARD S. MORSE.

Among the most common of our fresh-water mollusks are the air-breathing water snails. Muddy lakes, ponds, streams and marshes, being their favorite abodes, and even ditches sometimes swarming with them. It would be difficult to find a body of fresh-water that did not contain certain representatives of this class.

Their shells are quite uniform in texture and color, containing but little lime, and for this reason are quite light, and even in some species slightly elastic. They are quite hardy in confinement, and a few specimens secured in early spring time will afford many pleasant hours of amusement to those interested in watching their habits. They have to come often to the surface of the water to breathe, and it is curious to watch them during this operation. The snail with its broad disk slowly sweeping along the glass, feeding at the same time by lapping up whatever particles of food it may meet with. As it nears the surface the shell is inclined in such a way that the aperture is brought almost out of water, and then a funnel-like process is opened in such a way that the air enters the respiratory cavity, while the water seems to be repelled by the edge of the funnel.

During the spring time the eggs are laid and attached to some substance by a transparent mucous. If laid upon the glass walls of an aquarium, or the sides of a glass dish,

the complete development of the egg into a little snail, may be easily watched with a common magnifier. When nothing more than a cluster of cells may be defined within the egg, this mass is seen to slowly and continually revolve within. Soon two little eyes make their appearance, and by successive stages the shell is formed, and with a high magnifier the little one may be seen eating its way through the egg-shell and mucous which surrounds it.

These snails have the power of crawling or floating along the surface of the water, the creeping disk being just level with the surface and the shell hanging beneath. When they wish to sink, a portion of the air contained in the lung cavity is expelled, and a slight clicking sound is heard accompanying this movement. They are mostly vegetable feeders, and seem to live on the ooze and slime that cover the stones and aquatic plants of their abode.

There is one little species that seems more like a land snail in its habits, from the fact that it can live a long time without immersion in water. It is generally found in little pools, where the water stands only a portion of the year. During the dry season it hibernates like the land snails by plugging up the aperture of the shell with a thin partition of a viscid secretion of the animal, and in this condition will survive the droughts of summer.

A simple and serviceable collecting apparatus can be made from a tin dipper fastened to a pole six or eight feet in length. The bottom of the dipper should be made of wire netting. With this one can scoop along the bottom of ditches and ponds, and will be rewarded by finding many a curious shell. And if he is at all interested in insects he will turn up some singular looking monsters in miniature, that will turn out to be the larval state of dragon flies or other well known forms. Even without the dipper the collector may find many species by examining the bits of bark and stone and the stems of aquatic plants that he may pull up from the pond. The under side of lily-pads also proves a resting

place for certain species. With the results of a day's collecting before him he will probably find the following genera of air-breathing water snails represented.

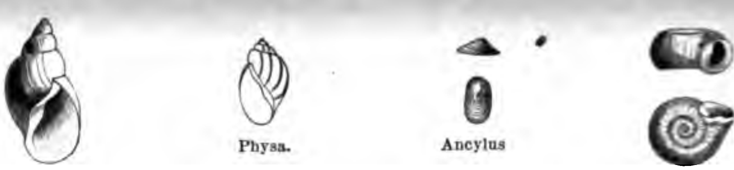
Lymnæa, in which the aperture of the shell is on the right side, when the shell is held with the apex upward, and the aperture facing you, the tentacles being broad and triangular.

Physa, in which the aperture is always on the left side, if the shell is held in the position just described, and the tentacles slender.

Planorbis, in which the shell is always coiled in a plane so that there is no elevated spire.

Ancylus, in which the shell differs very widely from all the rest in having no twisted spire, but in having the shape of an oval flattened bowl.

There is a common marine shell called *limpet* that the shell of *Ancylus* greatly resembles in form, though the animals are entirely unlike.

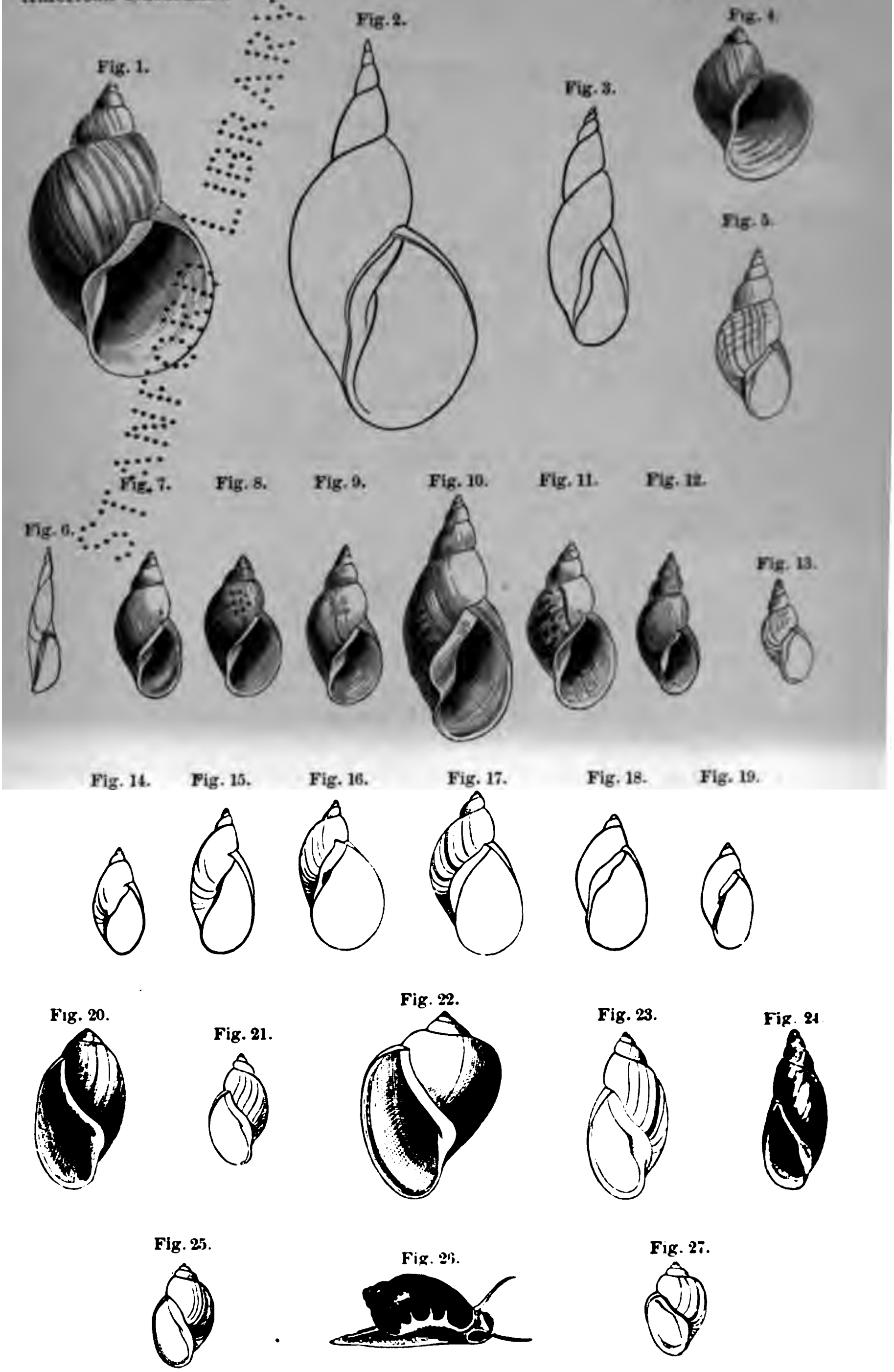


Lymnæa. Physa. Ancylus Planorbis.

We here give figures of these four characteristic forms, side by side, and these are represented in North America by about one hundred and twenty species, according to Binney.

In the plate we have figured some of the prominent species of *Lymnæa* and *Physa*, the cuts having been loaned us by the Smithsonian Institution, whose publications in this department have been of great value to the student in quest of these animals.

In the explanation of plate the distribution of the species represented is given. We may add that the species of these genera are very perplexing to define, and will require



MORSE ON FRESH-WATER SHELLS.

much patient labor to characterize those that are truly species and those that are varieties only.

EXPLANATION OF PLATE 11.

Fig. 1. *Lymnæa megasoma* Say. Lake Champlain to Michigan.
" 2. " *appressa* Say. Northern States to Pacific.
" 3. " *reflexa* Say. Northern States.
" 4. " *decollata* Mighels. Maine, Connecticut.
" 5. " *proxima* Lea. California.
" 6. " *gracilis* Jay. Lake Champlain to Michigan.
Figs. 7, 8, 9, 10, 11, 12. *Lymnæa elodes* Say. Northern United States.
Fig. 13. *Lymnæa desidiosa* Say. New England to Kansas.
Figs. 14, 15, 16, 17, 18, 19. *Lymnæa columella* Say. New England, Lake Superior, Georgia.
Fig. 20. *Physa ampullacea* Gould. Oregon.
" 21. " *Virginea* Gould. California.
" 22. " *Lordii* Baird. British Columbia.
" 23. " *gyrina* Say. Northern United States; figured from original specimen.
Fig. 24. *Physa elongata* Say. Northern United States.
" 25. " *heterostropha* Say. Throughout United States.
" 26. " " Animal expanded.
" 27. " *humerosa* Gould. Colorado Desert.

WHAT IS BATHYBIUS?

BY PROFESSOR W. C. WILLIAMSON, F.R.S.

DURING each successive year the Protozoa prove to be of increasing importance to the physiologist. In no other class of matured animals can the protoplasm, of which we have recently heard so much, be studied to such advantage. Constituting the lowest known manifestation of both animal and vegetable life, it seems to bring us very near to the boundary between the organic and the inorganic worlds. It exhibits the simplest phenomena of life under the least complex of conditions; hence it has recently been appealed to by one of the most philosophical of living zoologist as capable of

throwing light upon the most recondite of biological problems. Without accepting all, or even the chief of the conclusions at which Professor Huxley has arrived from his study of protoplasm, he must be deemed right in the importance which he assigns to it. Whether seen as the gelatinous sarcode of the Protozoa, occupying the base of the animal kingdom, or as the yolk-material out of which the embryo of the highest vertebrate is formed; whether we observe its plastic mass in the primordial germ of a Protococcus or of a Volvox, or as it appears in the leaf-bud of an oak, it everywhere brings before us the first stage in acts of organization in which it is the chief, if not the only actor. Nevertheless, I am unable to see that our study of protoplasm has brought us nearer than before to a knowledge of the origin of that mysterious force which converts inorganic into organized material. There yet remains to be bridged over that unfathomed gulf which separates death from life — the most complex effects of inorganic forces from the simplest of vital phenomena. We can trace the action and development of protoplasm through successive generations of organisms; but, like the spot where the rainbow touches the ground, its mysterious origin recedes as we advance, and a weary chase leaves us no nearer our object than when we commenced its pursuit. We increase our information respecting the conditions of its existence, but not of its origin; and I believe that from the nature of the problem this ignorance will continue.

We are asked, wherein does the so-called vital force differ from other physical forces? Oxygen and hydrogen combine to form water; if you admit vitality, why not require a principle of æquosity to explain this combination and its resultant phenomena? "What better philosophical status," asks Professor Huxley, "has vitality than æquosity?" I reply, we require the admission of no new force to explain the combination of gases in the formation of water. The phenomena occur in accordance with known laws of affinity.

The synthetical experiment is but one of a vast series of similar experiments, in each of which we can combine separate elements with absolute certainty that the resultants will be identical with, and fulfil all the functions of, the same products when formed in nature's laboratory. But the case is different when we turn to living organisms. We may know the proportions of oxygen, hydrogen, carbon, and nitrogen, existing in any form of protoplasm, and we may even succeed in forcing those elements into an artificial combination having the same proportions, but in no single instance have we been able to endow such a combination with the powers of life. The resultant is not protoplasm. It does not live. It performs none of the vital functions. "Certain conditions" are wanting, and, so far as experiment has hitherto gone, the laboratory has proved unable to supply those conditions. Some "force" is required which is not under the control of the ablest physicist, and which differs in kind as well as in degree from those with whose operations he is familiar. We infer this, because all the functions of the resultant of nature's organic synthesis are different from those of all artificial products. It is this lacking force which we indicate under the name of vital; and so long as experimental philosophers fail to make their artificial combinations do what it does, I claim to be as philosophical, and to be acting in as truly a scientific spirit, when I recognize its existence as when I speak of a magnetic force or of a force of gravitation.

Professor Huxley asks, "What justification is there, then, for the assumption of the existence in the living matter of a something which has no representative or correlation in the not living matter which gave rise to it?" Surely the question, thus put, involves a fallacy. Professor Huxley admits that to produce the results referred to the introduction of a new element is needed. The not living matter requires the aid and instrumentality of matter that is living, and it is precisely this necessity which leads me to conclude that the

living matter *does* contain something wanting to the "not living matter."

The living organism increases, multiplies, and reproduces itself through a power that is inherent, whereas a crystal can only do so through powers external to itself; whatever it may be, the vital power is always derived; no *known* combination of inorganic elements or dead forces could have created it. Except in a few obscure cases, too ill-understood to be made the basis of a grave argument, protoplasm can always be traced, directly or indirectly, to some preëxisting form of protoplasm. We nowhere discover any power which, without the intervention of some already living agent, can convert inorganic matter into living matter. If we could even trace back the history of protoplasm, until we reached one of Mr. Darwin's primæval germs, our philosophy would still leave the first of these living azotized combinations unaccounted for. Since, then, scientific experience affords no proof that life is nothing more than a function of material combinations, acted upon by physical forces, we are justified in the recognition of a vital principle, emanating primarily from a living Creator, but which, once created, appears capable of self-perpetuation to the end of time.

If, having recognized the importance of the study of protoplasm amongst the lower animals, we commence its pursuit, we soon discover the difficulties which surround it, especially when we discover the apparent inadequacy of the causes to the effects produced. We see a granular jelly evolving endlessly varied forms of grace and beauty; at one time using silica as its raw material, at another carbonate of lime. Here it glues together grains of sand, there it develops a new sand-like compound, the very nature of which has yet to be discovered. In one form it produces the horny network of a sponge — in another the ethereal tracery of an Euplectella. The colors of its products are almost as varied as their material forms. We seek the cause of all this rich diversity — but seek in vain. We see the almost

motionless granular jelly investing the objects of beauty which it has constructed, but it affords us no indication of the secret of its wondrous power.

We hail every new fact tending to throw light upon a history which is as obscure as it is marvellous. Hence the importance attached to Professor Huxley's discovery of the vast masses of submarine protoplasm, to which he has given the name of *Bathybius*. When, in 1857, Capt. Dayman, of H.M.S. Cyclops, returned from his exploration of the bed of the Atlantic, some of his specimens of "soundings" were placed in the hands of Professor Huxley for examination. The explorers had already noticed the singular stickiness of the mud brought up by the lead, and Professor Huxley soon found that this viscid condition arose from the diffusion through it of abundance of sarcode or protoplasm of a protozoic nature. The mud, like much of what constitutes the bed of the Atlantic, consisted of chiefly accumulated shells of *Globbigerna bulloides* — themselves the skeletons of a protozoic sarcode. The Bathybius occurred in minute patches of gelatinous protoplasm, usually of irregular shape, but occasionally assuming roundish forms. It consisted of a transparent jelly containing innumerable, very minute, granules, many of which Professor Huxley found to be equally soluble in dilute acetic acid and in strong solutions of the caustic alkalies; but, in addition, there occurred some remarkable bodies to which great interest is attached. In the first instance Professor Huxley noticed, adherent to the protoplasm, and occasionally embedded in it, numerous minute rounded bodies, soluble in acids, and to which he gave the name of *Coccoliths*. Still later, in addition to these Coccoliths, Dr. Wallich discovered, associated with the Bathybius, some larger spherical bodies of more complex organizations which he designated *Coccospheres*. Yet more recently Professor Huxley has reëxamined his specimens under higher powers, and found his Coccoliths were of two classes — to which he now gives the respective names of *Discolithus* and *Cyatho-*

lithus. The Discolithi he describes as "oval discoidal bodies, with a thick strongly refracting rim, and a thinner central portion, the greater part of which is occupied by a slightly opaque, as it were, cloud-patch. The contour of this patch corresponds with that of the inner edge of the rim, from which it is separated by a transparent zone. In general the Discoliths are slightly convex on one side, slighty concave on the other, and the rim is raised into a prominent ridge on the more convex side."* These objects usually range from 1 to $\frac{1}{5000}$ of an inch in their longest diameter.

The Cyatholiths are like minute shirt-studs. They are stated to have "an oval contour, convex upon one face, and flat or concave upon the other. Left to themselves, they lie upon one or other of these faces, and in that aspect appear to be composed of two concentric zones surrounding a central corpuscule." "A lateral view of any of these bodies shows that it is by no means the concentrically laminated concretion it at first appears to be, but that it has a very singular and, so far as I know, unique structure. Supposing it to rest upon its lower surface, it consists of a lower plate, shaped like a deep saucer or watchglass; of an upper plate, which is sometimes flat, sometimes more or less watchglass-shaped; of the oval, thick-walled, flattened corpuscule, which connects the centres of these two plates; and of an intermediate substance, which is closely connected with the under surface of the upper plate, or more or less fills up the interval between the two plates, and often has a coarsely granular margin. The upper plate always has a less diameter than the lower, and is not wider than the intermediate substance.†" These Cyatholithi are further stated to vary in size from $\frac{1}{6000}$ to $\frac{1}{8000}$ of an inch in diameter. The Cocco-spheres are described by the same distinguished observer as

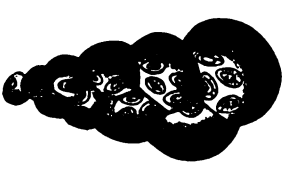
* On some Organisms from great Depths in the North Atlantic Ocean, *Quarterly Journal of Microscopical Science*, Oct., 1868, p. 206.

† Ibid. p. 207.

"of two types — the one compact and the other loose in texture. The largest of the former type which I have met with measured about $\frac{1}{1300}$ of an inch in diameter. They are hollow, irregularly flattened spheroids, with a thick transparent wall, which sometimes appears laminated. In this wall a number of oval bodies, very much like the 'corpuscules' of the Cyatholiths, are set, and each of these answers to one of the flattened facets of the spheroidal wall. The corpuscules, which are about $\frac{1}{4500}$ of an inch long, are placed at tolerably equal distances, and each is surrounded by a contour-line of corresponding form." "Coccospheres of the compact type of $\frac{1}{1700}$ to $\frac{1}{2000}$ of an inch in diameter occur under two forms, being sometimes mere reductions of that just described, while, in other cases, the corpuscules are round, and not more than half to a third as big, though their number does not seem to be greater. In still smaller Coccospheres, the corpuscules and the contour-lines become less distinct and more minute, until, in the smallest which I have observed, and which is only $\frac{1}{4500}$ of an inch in diameter, they are hardly visible."

"The Coccospheres of the loose type of structure run from the same minuteness up to nearly double the size of the largest of the compact type, viz., $\frac{1}{780}$ of an inch in diameter. The largest (of which I have seen only one specimen) is obviously made up of bodies resembling Cyatholiths of the largest size in all particulars except the absence of the granular zone, of which there is no trace. I could not clearly ascertain how they were held together, but a slight pressure suffices

Fig. 101.*



* Fig. 101 is a "sketch of a mature eight-chambered Textularian shell, each segment of which is studded with Coccoliths. The specimen referred to was obtained along with numerous others, from a depth of 1913 fathoms (upwards of two miles) between the Coasts of Greenland and Labrador." Dr. Wallich from whom we quote, believes "that the Coccospheres are the parents of the Coccoliths." See his article "On the Vital Functions of the Deep-sea Protozoa," *Monthly Microscopic Journal*, No. 1, Jan., 1869, 8vo, London. — *Eds. Nat.*

to separate them." * The relations subsisting between these Coccospheres on the one hand, and the Cyatholiths on the other, are very obscure; but Professor Huxley deems it probable that some close affinity does exist; but whether the Coccospheres have been formed from a coalescence of Cyatholiths, whether the Cyatholiths have resulted from the breaking up of the Coccospheres, or whether the Coccospheres are altogether independent structures, yet remains to be decided. There appears, however, no reason to doubt that Coccoliths, Coccospheres and Cyatholiths, equally belong to Bathybius, as the skeleton of a sponge, or the shell of a Foraminifer belong to their respective protoplasmic sarcodes.

Since Professor Huxley completed the observations to which I have referred, Dr. Carpenter and Professor Wyville Thompson have conducted a very important series of deep-sea dredgings off the north coasts of Scotland, and in the neighborhood of the Faroe Islands. In Capt. Dayman's dredging operations the viscid mud was found between the fifteenth and forty-fifth degrees of W. longitude. Those of Drs. Carpenter and Thompson were carried on much further eastward; but in the latter instance the same deposit was found over a range of at least two hundred miles, throughout which the dredge came up from time to time filled with Globigerina-mud and saturated with Bathybius, with its associated Coccoliths and Coccospheres. The Globigerina deposit exists in a similar manner in many and distant parts of the ocean, in both hemispheres; and it is more than probable that when the remote localities are subjected to the same examination as our northern seas have recently undergone, Bathybius will be found in them also. Its low organization renders it probable that it will be found to be like its companion Globigerina, a thorough cosmopolite. On this point Dr. Carpenter suggests that the range of these objects is regulated by temperature rather than by locality. It was

* On some Organisms from great Depths in the North Atlantic Ocean, *Quarterly Journal of Microscopical Science*, Oct., 1868, p. 209.

already known that many deep-sea localities existed, in which the Globigerina-mud did not occur; and it had even been suggested that its range was limited to that of the warm Gulf-stream. Dr. Carpenter confirms this general conclusion, and points out that its prevalence is connected with a bottom temperature of 45°, which in our northern latitudes can only be attributed to the Gulf-stream.

Bathybius yet requires to be considered in two other important relationships — the one geological and the other zoological.

Chalk, examined microscopically, has long been known to abound in minute ovate organisms, known as crystalloids, associated with the Globigerinæ and Textillariæ, of which chalk mainly consists. I recognized the organic origin of these bodies in 1847, and figured (Fig. 102) one of them very imperfectly, viewed as an opaque object, in my memoir "On some of the Microscopic Objects found in the Mud of Levant;"* but, ignorant of Coccoliths, I concluded that they belonged to some minute form of Oolina or Lagena. More recently Mr. Sorby has subjected these bodies to a much more careful examination, and both he and Dr. Wallich have identified them with Professor Huxley's Coccoliths. It now appears that both Coccoliths, Cyatholiths and Coccospheres, occur fossilized in the chalk, establishing, in a remarkable manner, the close resemblance of the conditions under which the chalk-beds were formed and those existing along the tract of the Gulf-stream at the present day. Dr. Carpenter goes even further than this, and regards it as "highly probably that the deposit of Globigerina-mud has been going on over some part or other of the North Atlantic sea-bed, from the Cretaceous epoch to the present time (as there is much reason to think that it did elsewhere in anterior geological periods), this mud being not merely *a* chalk formation, but a continuation of *the* chalk formation;

Fig. 102.

* "Trans. Phil. Soc., Manchester," Vol. viii, fig. 71.

so that *we may be said to be still living in the cretaceous epoch*."*

With the earlier part of the preceding paragraph I partly agree, but from its concluding sentence I must dissent. Chalk chiefly consists of an accumulation of Globigerina cretacea, *associated in almost equal proportions* with a minute Textillaria and with Coccoliths. The fossil Globigerina is probably but a mere variety of the recent G. bulloides; hence so far as it is concerned, ancient and modern deposits may have been continuous. But in none of the modern Globigerina beds which I have examined have I found anything resembling the fossil Cretaceous Textillaria, the disappearance of which requires to be accounted for. What I believe to be the same species occurs abundantly, amongst other modern types of Foraminifera, in the recent sandy deposit underlying Boston in Lincolnshire, but I never succeeded in discovering it living in the sea. From some unknown cause it has disappeared. On the other hand, our modern deposits abound in Diatoms and Radiolariæ, of which no trace appears in the true Cretaceous beds. That in the depth of the Atlantic Cretaceous and modern deposits may be conformably and continuously superimposed is not impossible, but conformable continuity of series does not constitute identity of age or of formation. In the Speeton clay of the Yorkshire coast we have, in the same blue deposit, a transition from the Oolites to the Cretaceous beds. The *deposits* have continued to accumulate without physical change from the one age to the other, but the *formations* to which the upper and lower portions of this clay belong are distinct, and represent distinct epochs. Dr. Carpenter is disposed to conclude that the higher forms of the Atlantic and Cretaceous faunæ will prove to be nearly identical; but I doubt this, and we must not repeat the blunder of Ehrenberg, in the case of the *tertiary* beds of the Mediterranean coasts, which he regarded as Cretaceous, because he found

* "Proceedings of the Royal Society," Vol. xvii, p. 192.

that they abounded in Cretaceous types of Foraminifera, overlooking the wide differences presented by the higher organizations of the two formations. So in the instance under consideration. Owing to the low vitality of the Protozoa, some of them have survived the changes which time has wrought in the higher groups of animals. The recent Globigerinæ and Bathybia are probably descendants from those which lived during the Cretaceous period, but their companions are not the same. The abundant Textillariæ are replaced by Diatoms and Radiolariæ. Instead of Marsupites we have the Rhizocrinus. The Ananchytes and Galerites are represented by Cidarites and Spatangi; amongst star-fishes Tosia (Goniaster) has given place to Ophiocoma. For the chambered Cephalopods we have the modern cuttle-fishes, whilst the Saurians and Ganoid fishes of the Cretaceous age have left no descendants in these Atlantic depths, their places being taken, in all probability, by the more familiar and much more useful codfish.

The zoological affinities of Bathybius are not very difficult to understand, though the young student is apt to become bewildered by the growing number of classifications of the Protozoa that are being offered for his acceptance, and the multitude of new terms with which, in consequence of these new classifications, our journals have become loaded. The last of these arrangements is that of Häckel, who has separated the Protozoa, under the name of Protista, equally from plants on the one hand and from animals on the other. He regards them as the common starting-point from which, in accordance with Darwinian ideas, both plants and animals have derived their origin. Without necessarily accepting this creation of a third organic kingdom, we may beneficially recognize Häckel's division of the Amæban section of the Protozoa into two groups, viz.: the Monera and the Protoplasta; the former comprehending those Amæbæ which exhibit an uniform granular sarcode without any trace of or differentiation into

special organs, and the latter including those types in which we have such special structures in the form of contractile vesicles, nuclei, or other differentiated appendages. So far as the structure of the sarcode is concerned, Bathybius is apparently a true Monera, and such its discoverer considers it to be. At the same time, the existence in connection with it of Coccoliths and Cyatholiths indicates the necessity for separating it from Häckel's other Monera, which have no such special appendages. But the time has not arrived for determining the absolute relations of these objects. New types, as Häckel himself admits, are being discovered, rendering modifications of his groups necessary. Meanwhile there can be no question that Bathybius is the lowest of those known Protozoa, which, like the Foraminifera, secrete calcareous elements. Remembering the extent to which the sarcode is diffused through the mud of the Atlantic, there appears much that is suggestive and important in the observation of Dr. Carpenter, that, had its power of secreting a calcareous framework been somewhat increased, so that instead of detached structures in the form of Coccoliths, etc., it had produced a continuous calcareous mass, it would have given us a living prototype of the Laurentian Eozoon. The discovery of this widely and continuously diffused Bathybius strongly sustains Dr. Carpenter in his conviction of the animal origin of that primæval structure.—*Popular Science Review*, October, 1869.

REVIEWS.

Results of Deep Sea Dredging between Cuba and Florida.*—Mr. A. Agassiz makes a "Preliminary Report on Echini and Starfishes Dredged in Deep Water." Part 1st is devoted to descriptions of new genera and

* Bulletin of the Museum of Comparative Zoology, No. 9, Preliminary Report on the Echini and Starfishes Dredged in Deep Water between Cuba and the Florida Reef, by L. F. de Pourtales, Ass't U. S. Coast Survey. Prepared by Alexander Agassiz, pp. 253-318.

new species. The second part is "On the Young Stages of Echini." The collections of Count Pourtales included many very young specimens. With these Mr. Agassiz has been able to study the young of thirty odd different species belonging to as many different genera. These observations seem to us so important and interesting that we give below a few extracts showing some of the general conclusions at which the author has arrived and the direction in which his labors are likely to affect the received ideas of the relations of the Echini amongst themselves.

"The changes some species undergo are so great that nothing would have been more natural than to place the two extremes of the series not only in different species, but often in different genera, and even in different families."

The different stages of growth of *Toxopneustes drobachiensis* Ag., represent in the younger stages Cidaris, then Hemicidaris, then Pseudodiadema, Echinocidaris, and Heliocidaris.

In Cidaris, Diadema, and Garelia, the changes are less marked, and in Echinometra they are greater than in any other genus of the regular Echini.

"We frequently find specimens of the same size, where in one case the outline is almost circular, the test flattened, covered with long slender spines, while in the other the test is lobed, swollen, high, surmounted by numerous short stout spines.

Among the Clypeastroids we find in the young during their growth great changes of form and structure taking place."

The transformations of *Mellita testudinata* and *Encope emarginata* are described as identical, whilst those of *Mellita testudinata* and *Mellita hexapora* are not so much alike, although both of the same genus.

"The development of *Stolonoclypus prostratus*, and flat Clypeastroids of the type of *Clypeaster placunarius* is most instructive, tending to show that in connection with the development of the Scutellidæ above described, we must probably introduce a complete reform among the genera recognized as Lemtia, Scutellina, Runa, Echinocyamus and other minute Echinoids, which may eventually prove to be nothing but the young of other Clypeastroids, as Mellita, Scutella, Laganum, Stolonoclypus, Clypeaster, Encope, and the like; but want of sufficient material prevents me from entering into this comparison more in detail. Though we know now, from what has been said above, that the Scutellidæ pass through phases which cannot be distinguished from Moulinsia Fibularia, Runa, Scutellina, and the Clypeastroids proper pass, as I shall show below, through a stage of growth identical with Echinocyamus."

"The development of Echinolampas has thrown unexpected light upon the affinities of the toothless Galerites and of the Cassidulidæ. It shows conclusively that Echinoneus is only a permanent embryonic stage of Echinolampas, thus becoming allied to the Cassidulidæ, and that it has nothing in common with the Galerites as I would limit them, confining them entirely to the group provided with teeth."

This part of the work is full of important observations giving detailed descriptions of the development of the species in support of the general propositions a few of which we have quoted above.

Part No. III. is on their Bathymetrical and Geographical Distribution. Here Mr. Agassiz reaches a most important and interesting conclusion. He concludes, from a specimen of Ananchytes, probably *Ananchytes radiata* found on the Isthmus of Panama, that the Pacific and Gulf of Mexico were united during the Cretaceous period, and have since been separated by the gradual rise of the land. This rising of the Isthmus, separating first the deep sea Cretaceous forms, then those of the next zone, which Mr. Agassiz says are "representatively of Tertiary genera," and finally dividing the littoral species which are now represented by numerous

closely allied or identical species. The fact that we are now to look for zones of life in which the genera are representative of former geological ages from the Cretaceous upwards, according to their depth, if true, is not less interesting than Professor Forbes' original discovery of the bathymetrical distribution of marine forms. The investigators of the two faunæ have generally speaking agreed either in considering some of the species in their different branches of research as identical, or very closely allied, although found on different sides of the Isthmus. Prof. Verrill, however, at the last meeting of the American Association, showed that the massive reef building corals of the Atlantic side were, with the exception of the genus Porites, wholly wanting on the Pacific, a difference which could not be accounted for if there had been any very wide channel communicating between the two oceans since the existing species came into being.

Mr. Duncan, from his investigations in his article "On the Fossil Corals of the West Indian Islands,"* is disposed to admit the connection of the two oceans during the Tertiary Period and this upon the grounds that genera resembling the present Indo-Pacific forms predominated in the Tertiary formation over those which are allied to genera now existing in the Caribbean seas, and Mr. J. C. Morse,† who has examined the fossil shells of San Domingo, confirms this view so far as to admit that Tertiary species like those now living in the Pacific are found in the rocks of that island.

It would appear, therefore, from these conclusions, and those reached by Mr. Agassiz and Professor Verrill, that the connection of the faunæ must have been much more general in former geological periods, and that Indo-Pacific species actually did at one time cross their present boundaries and encroach upon the Atlantic, although subsequently driven back to their original limits.

The absolute identity of existing species of fishes common to both shores of Central America, and the similar physical conditions under which they exist, as pointed out by Dr. Günther,‡ forms another element in this curious problem.

If the developmental hypothesis is adopted, how shall we account for some species varying so as to become representative of each other after being separated for some time and others remaining invariably the same?

If some departed from their original types either by the direct action of physical causes or through natural selection, why did others, closely allied to them anatomically, remain unchanged? Why do we not have in the fresh-water lakes of Managua and Nicaragua some forms such as the Crustaceans and fishes found in the fresh-water lakes of Sweden, which were formed by the rise of the lands now dividing the Baltic from the Arctic Ocean?

Why did the Pacific fauna retreat after the Tertiary period, leaving, as

* Quarterly Journal Geological Society of London, xix, 1863. † Ibid., 1858.
‡ Trans. Zool. Soc., London. VI, p. 397, 1868.

Mr. Lyman shows below, the Caribbean fauna in undisputed possession of the Atlantic side, with outlying species on the Pacific shores?

Do Cretaceous forms occupy the depths, and Tertiary genera the middle ground of the coast on the Pacific side, and if so, what are the relations of these facts to the geological history of North America?

These are a few of the questions which present themselves and which can only be answered by farther investigation.

The expedition of the English government, sent out during the past season, dredged at the enormous depth of two thousand four hundred fathoms (nearly the height of Mont Blanc) and brought up living organisms. Though our own expeditions have not obtained specimens from such deep soundings the results have been none the less interesting.

It was announced by Professor L. Agassiz at the last meeting of the American Association, that it was the intention of the Superintendent of the Coast Survey to carry out other lines of sounding from the Atlantic side and still others from the Pacific shore.

The enlightened spirit of appreciation for the present needs of science displayed in these expeditions of the Coast Survey, and the great importance of the results they have already attained, promise to accomplish as much for the progress of Natural History in this country as they have hitherto for that of Geography and the Physical History of the sea.

Part IV. contains a "List of Star-fishes, which, though ranging through depths of from five to one hundred and seventy-four fathoms, present an unexpected departure from what was offered in other dredgings."

"With the exception of the Pteraster and *Asteracanthion tenuispinum* the bathymetrical and geographical distribution of the star-fishes do not show any striking features."

Mr. Lyman's report* on the Ophiuridæ and Astrophytidæ shows that all the new types of these families are found only below one hundred fathoms. Seven of these new genera are described at length. Mr. Lyman's conclusions are confirmatory of those published by Mr. Agassiz; he, however, does not seem prepared to go quite so far.

In showing that there are obstacles in the way of the hypothesis that the Gulf of Mexico and the Pacific were joined by a strait across what is now the Isthmus of Panama, the author asks a very pertinent question. Why do we not find Pacific forms on the Caribbean side? The evidence all goes to show that there has been a migration of species from the Caribbean to the Pacific, but none from the Pacific to the Caribbean. This objection has already been partially answered, as we have remarked above, by investigations upon the Tertiary shells and corals of the West Indian Islands.

Count Pourtales' report† gives us a descriptive list of the Crinoids.

* No. 10, Bulletin of the Museum of Comparative Zoology. Report on the Ophiuridæ and Astrophytidæ dredged in deep water between Cuba and the Florida Reef, by L. F. de Pourtales, Assistant, U. S. Coast Survey. Prepared by Theodore Lyman. pp. 309-354.

† Bulletin of the Museum of Comparative Zoology, No. 11. List of Crinoids obtained on the Coast of Florida and Cuba, by the United States Coast Survey, Gulf Stream Expeditions, in 1867, 1868, 1869. By L. F. de Pourtales, Assistant, U. S. Coast Survey, pp. 355-358.

The late researches of Professor Sars upon the anatomy of this singular group has given it a preponderating interest to readers of these researches, and Count Pourtales' list shows that we may expect still greater additions to our knowledge. The author describes five new species of Antedon, and mentions that *Pentacrinus Mülleri* was found at a depth of two hundred and seventy fathoms off Havana, and at three hundred and fifteen fathoms off Double-headed Shot Keys, but not on the Florida side of the Gulf Stream.

Rhizocrinus Lofotensis has been obtained several times during the season of 1869, in depths varying from two hundred and thirty-seven to four hundred and fifty fathoms. The author also states that he has seen the collections of Professor Smith, made on the Josephine bank, a remarkable and almost precipitous elevation of the bed of the Atlantic, accidentally discovered by the Swedish Frigate Josephine between the coast of Portugal and the Azores. In this collection he saw *Rhizocrinus Lofotensis*, *Echinocucumis typica* and *Pteraster militaris*, species common to the coast of Norway and the deep sea fauna of the Gulf.

"The Holothurians* obtained in deep water off the Florida reef are few in number, and are very closely allied to, if not indentical with, those of the deep sea fauna of Norway. The littoral species, so abundant on the reef, do not appear to extend into even moderate depths outside, at least they were never found in the dredge."

Fossil Crinoids of Ohio and Kentucky.†—This article comprises descriptions of thirteen new species and two new genera, Hadrocrinus and Ataxiacrinus. Mr. Lyon has passed some thirty years in perfecting the collection which forms the basis of his descriptions in the neighborhood of the Falls of the Ohio, and the thoroughness of his descriptions derive additional value for the interesting character of this locality. The new species belong respectively to genera, Hadrocrinus, Actinocrinus, Cyathocrinus, Poteriocrinus, Platycrinus, Dolatocrinus, Ataxiacrinus, and Zeacrinus.

Monograph of the Phasianidæ.‡—Under this title Mr. Elliot, who is now in London, proposes to issue a companion work to his large and beautiful folio monographs of the "Grouse Family," the "Ant Thrushes," and his work on the "New and Heretofore Unfigured Birds of North America." The proposed work will contain figures, with accompanying text, of all the known species of Pheasants, Jungle Fowl, Turkeys, Pea Fowl, Guinea Fowl, etc. The plates will represent the species of life size and will be from original paintings by Wolf, lithographed by Keulemans and colored by hand. The monograph will be completed

* Bulletin of the Museum of Comparative Zoology, No. 12. List of Holothuridæ from the Deep Sea Dredgings of the United States Coast Survey. By L. F. de Pourtales, Assistant U. S. Coast Survey, pp. 359-361.

† Remarks on thirteen new species of Crinoidea from the Palæozoic Rocks of Indiana, Kentucky and Ohio; and a description of certain peculiarities in the structure of the columns of Dolatocrinus, and their attachment to the body of the animal. By Sydney S. Lyon. Transactions of Amer. Phil. Soc., Vol. 13, pp. 443-446, with two plates.

‡ By D. G. Elliot. Five parts, folio. Zoological Society, London.

in five parts, each part containing fifteen plates. Not more than two parts a year will be issued, and they will be sold to *subscribers only* at four guineas each part. This proposed work will be a handsome addition to the libraries of all who can afford so great a luxury, and we trust that, as the price is beyond the means of most students of ornithology, copies will at least be secured for the principal libraries of this country It will give us pleasure to forward subscriptions for the work, or Mr. Elliot can be addressed direct, care of the Zoological Society, London.

MONOGRAPH OF THE KINGFISHERS.* — We have already called attention to this beautiful monograph, six parts of which, containing the letter-press and plates of *forty-nine* species of this brilliant family of birds, have been received. The plates are most beautifully executed in colors by Mr. KEULEMANS, and the work is in every way worthy the support of Ornithologists in this country, and of all others who may wish for a handsome work for their library or drawing room. At present we notice that our own copy is the only one taken in America, but we trust that this will not be so long, and that before the last part is issued we shall see the names of several of our patrons of science on the list; but if they are to be there it must be done soon, as only two hundred copies of the work will be published, and the sixth number, issued in October last, shows already a list of one hundred and twenty subscribers. The work is to be completed in fourteen parts, each part containing at least eight plates. Professor MURIE is to contribute a chapter on the Anatomy and Osteology of the Kingfishers illustrated by plates.

A MONOGRAPH OF THE CAPITONIDÆ.† — We take pleasure in calling attention to the prospectus of this companion work to Mr. Sharpe's "Monograph of the Kingfishers." Like the latter birds, the Capitonidæ are possessed of the most brilliant and varied plumage, and considered as a whole, they are scarcely surpassed in beauty by any other family of the *Picariæ*.

"The authors feel that their experience in India has enabled them to gain a considerable knowledge of the general characteristics of the Eastern members of the family, while the recent exertions of Naturalists in Africa and South America, have materially contributed to elucidate the economy of the Barbets inhabiting these portions of the globe. While acknowledging the great amount of work that has been done of late years with regard to the Barbets, the authors cannot but believe that a Monograph of the family, giving full descriptions of the birds, their structure, habits, and general economy, accompanied by good illustrations of every species, will be an acceptable contribution to Ornithological Science. To render the work up to the standard which the present state of Science demands, no efforts will be spared; and it is intended to be not only a trustworthy hand-book of reference to the scientific student, but also a handsome addition to the Library or the Drawing-Room. The fact that the plates will be executed by Mr. J. G. Keulemans will be a sufficient guarantee for the excellence of this portion of the undertaking."

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* By R. B. Sharpe. Fourteen parts, 4to. Zoological Society, London. The subscription price of this work is 10*s*. 6*d*. each part. Orders will be taken at the *Naturalists' Agency* at the rate of $3.50 (currency) a part, or subscribers can remit directly to the authors, care of the *Zoological Society*, 11 Hanover Square, LONDON, W.

† By C. H. T. Marshall and G. F. L. Marshall. Eleven parts, 4to. Zoological Society, London. We shall be pleased to forward subscriptions at the same rates as for the "Monograph of Kingfishers," or the authors can be addressed care of the Zoological Society.

The work will be published in quarterly parts. Each part will contain eight beautifully colored lithographs, with accompanying letter-press. The whole work will contain about eighty plates, and will be completed in eleven parts. The first number is announced for January, 1870.

THE GEOLOGY OF ALASKA.* — The most interesting results of Mr. Dall's explorations are the determination of the facts that west of the 105th degree of longitude the Alaskan coast is rising, that the former violence of volcanic forces is diminishing throughout the territory, and that there are no evidences of general glacial action. Mr. Dall has travelled thirteen hundred miles up the valley of the Yukon, and explored on the shores of Norton Sound, without obtaining any evidences of glacial action. The whole territory north of the Alaskan Mountains could not, therefore, have been covered by the same general sheet of ice which has scratched the section east of the Rocky Mountains.

This raises an unexpected obstacle in the path both of the hypothesis of a general terrestrial glacial sheet, and the theory of floating ice. In either case it will be difficult to explain the absence of scratches on the northern slope of the Alaskan Mountains when all the rest of North-eastern America must have been covered by ice.

If Alaska was covered by the waters of the Pacific, why did not the floating icebergs score the surface, and if it was out of water during the glacial epoch, why did not the great terrestrial glacier of the east have its counterpart in the Arctic valley of the Yukon?

NATURAL HISTORY MISCELLANY.

BOTANY.

SPONTANEOUS MOTION OF PROTOPLASM. — Professor J. B. Schnetzler records in the "Archives des Sciences Physiques et Naturelles," some observations on the spontaneous motion of the protoplasm in the cells of the leaves of the common water weed, *Anacharis alsinastrum*. The writer remarks that whether the cause of the motion is found, as some have maintained, in the successive contractions or vibrations of the exterior layer of the protoplasm, which transmit themselves to the interior layers; or whether the successive displacements of the molecules is produced by causes purely mechanical, as others have held, it still remains to be explained what produces these contractions or displacements. It is incontestable that they are found only in living protoplasm. Professor Schnetzler believes that the principal cause which provokes the motion

* Observations on the Geology of Alaska, by W. H. Dall, 8vo, pamph., 12 pp. From the Alaska Coast Pilot, published by the Coast Survey.

is the chemical action of oxygen, which passes through the wall of the cell, and of which a portion is probably transformed into ozone under the influence of light, as occurs also in the globules of blood. The most strongly refracted rays of light have a marked influence on these currents, which are also no doubt affected by the currents of electricity which form, under the influence of water, between the surface of the leaf and the contents of the cells. The energy of the motion depends principally on the temperature, showing the greatest vigor between 16° and 20° C. In the point of view of mechanical theory, we have here evidently an example of the transformation of light and of heat into motion. The Anacharis is especially favorable for the observation of these motions; as, in consequence of the transparency of its tissue, they can be watched under the microscope without any preparation. — *Nature, London.*

STRAWBERRIES. — Of the *Everlasting Andine Strawberry*, which seems to attract considerable attention in England, Dr. Spruce, the celebrated botanical traveller in South America, writes that it is "doubtless one of those varieties of *Fragaria vesca* commonly cultivated throughout the Andes within the tropics, where the perpetual spring of that favored region has had the effect of rendering the strawberry perennially fruitful, and many of the deciduous-leaved trees of Europe evergreen. In the Equatorial Andes the province of Ambato is famous for its strawberries, which equal in size and flavor some of our best varieties, and which are to be seen exposed for sale in the market-place every day in the year." — *Gardeners' Chronicle, Dec.* 11.

ANOTHER WHITE VARIETY. — During the summer of 1868, while near the White Mountains, New Hampshire, I observed a white variety of *Epilobium angustifolium*. As I have not seen this mentioned in the NATURALIST, I contribute it to the list of floral albinos which has been so largely increased the past season. In the NATURALIST of several months ago, a white variety of *Viola cuculata* is spoken of by a Western writer. This color I do not think is unusual in this species, as I have observed it during the past ten years in Saratoga Co., N. Y., and have also seen it elsewhere. — HENRY M. MYERS, *Williamstown, Mass.*

BOTANICAL SPECIMENS. — A. H. Curtiss, Liberty, Bedford Co., Va., has botanical specimens (catalogue furnished) for exchange for specimens of Minerals, Geology, Shells and Insects.

ZOÖLOGY.

OCCURRENCE OF AN AMERICAN LAND SNAIL IN ENGLAND. — In a communication to the November number of the "Annals and Magazine of Natural History," by J. Gwyn Jeffries, the occurrence of *Planorbis dilatatus* Gould, is noticed at Manchester, England. Since it was found in a canal near the cotton mills, the writer suggests that in some way the eggs might have been conveyed there in the cotton from America, and thus intro-

duced the species. *Planorbis dilatatus*, however, does not occur in cotton growing regions, and therefore some other explanation must be made for its importation into England. Lately, *Bythinia tentaculata*, peculiar to Europe, has been found in the vicinity of Montreal. Whether these species are transported from one country to the other through commercial intercourse, or are really circumpolar species which have thus far eluded the collector's eye, must be decided by looking for the species in various and widely separated regions of the country.

"Zoologicus" has succeeded in misconceiving some very plain statements and in supplying some very rudimentary zoölogical information, which perhaps no reader of the "lilies" has felt the need of. The parallel drawn in the "lilies" is correct. The hexagonal form results in microscopic structures from equal growth in the three hexagonal axes; in the crystal it results from the aggregation of hexagonal particles. The other misconceptions of "Zoologicus" are so peculiarly his own that they need not be noticed. — Chemist.

The Museum of Comparative Zoölogy is prepared to furnish extensive collections of all the rocks and loose deposits found upon and about the keys and reefs of Florida; also complete collections of the corals, in fresh and well preserved specimens, in exchange for recent and fossil corals from other parts of the world. Address, L. Agassiz, *Director of the Museum of Comparative Zoölogy, Cambridge, Mass.*

Professor Agassiz. — "Our Young Folks" for January contains the best portrait of Professor Agassiz that we have ever seen, and we advise all who have not seen him, and wish to know how he looks, to send twenty cents to Fields, Osgood & Co., Boston, for a copy of the number, which also contains "A Sketch of the Life of Professor Agassiz."

Obituary of Michael Sars. — We have received a circular from the Royal University of Norway, announcing the death of Professor Michael Sars, from which we take the liberty of making a few extracts. Professor Sars was one of the foremost of those men whose attainments have of late years given a cosmopolitan reputation to Scandinavian science and literature. He died on the 22d of October, being then sixty-four years of age. Professor Sars graduated in theology in 1828, and subsequently presided in succession over the parishes of Bergen and Manger. His theological career appears to have been adopted merely as a means of gaining a livelihood, and, as it has been stated by an obituary notice in the "Scientific Opinion," the Sunday services were sometimes delayed when the pastor had met with unusual good fortune in his dredging trips. In 1854 he was appointed Extraordinary Professor of Zoölogy, a position which conferred upon him the precious boon of uninterrupted study. The life of this eminent Norwegian is full of encouragement to many American naturalists, many of whom are located, as Sars was until 1854, far away from books or museums, and obliged to work out their investi-

gations with "poor and incomplete" instruments. During the period referred to, Professor Sars completed many of his finest researches and began his greatest single work, the "Fauna Littoralis Norvegiæ."

GEOLOGY.

EVIDENCES OF THE GULF STREAM IN HIGH LATITUDES. — Admiral C. Irminger of the Danish Navy, has for nearly thirty years made observations on this subject, and states that "it can be said with certainty that the current in the Northern Atlantic flows towards the north, even up to the Icy Sea." Between Fairhill and Greenland a constant drift or slow current of the ocean, to the north was observed; and the mean of observations between 32° and 39° W. of Greenwich gave 3 : 2 nautical miles per day north. This drift of the ocean in a northerly direction towards the coast of Greenland, is besides observable in the temperature of the water.

This drift, or slow current in the Atlantic, is the cause why the harbors of Norway, even farther than North Cape, and as far as the Fiord of Varanger, are accessible for navigation during the whole year; just as the warm current, which passes Cape Reiklanæs, and runs to the northward along the western shores of Iceland, is the cause of the south and west coasts of this island being clear of ice, so that, even during the severest winters, ships may go to Havneford and other places in the Faxe bay of Iceland, where they always will be sure of finding open sea. If this current to the north in the Atlantic did not exist, the ice from the sea around Spitzbergen would float down to far more southern latitudes than is now the case; and certainly the coasts of Norway, as well as the sea between Shetland and Iceland, would frequently be filled with ice from the Icy Sea, and the influence of the ice would then be felt on the climate of the neighboring coasts. But this is not the case, and we know that the ice from the Icy Sea (Greenland ice) only can force its way to the southward between Iceland and Greenland, along the east coast of Greenland, rounding Cape Farewell, and afterwards passing Labrador, Newfoundland, and farther south."

Between Shetland and Cape Farewell there are found streaks of warmer water which are supposed to have their origin from the Gulf Stream. These may possibly be caused by the pressure of the current coming from Labrador, passing Newfoundland, etc., where this current influences more or less the limits of the Gulf Stream, causing its heated waters to be inclined sometimes more easterly, and at other times more westerly. "These warmer streaks, combined with the different tropical products, constantly thrown on the shores of Norway, the Faroe Isles, Iceland, Greenland, etc., I believe also to be a proof that the Gulf Stream sends its waters far to the north. Among the tropical products frequently found is the bean of the *Mimosa scandens*, which I found on the shores of Iceland. — *Scientific Opinion.*

ANSWERS TO CORRESPONDENTS.

C. G. A. Augusta, Maine.—The shrub from Schoodic River is *Lonicera cærulea*, or Mountain Fly-honeysuckle. The plant from Fox Island, Phippsburg, Maine, is *Polygonatum latifolium*, or Broad leaved Solomon's Seal.—J. L. R.

J. H. P., Portsmouth, N. H.—Your specimen is *Coccoloba platycladox*, a singular plant of the order of the Polygonums, or Knot weeds, and lately much cultivated. —J. L. R.

BOOKS RECEIVED.

Geological Report of the Exploration of the Yellowstone and Missouri Rivers. By F. V. Hayden. 8vo, pp. 174. Maps. (Government Report) 1869.

Annual Report of the Secretary of the Interior for the year 1869. 8vo, pp. 26. Washington.

Scientific Opinion. London. December 1, 8, 15, 22, 29.

Volcanoes and Earthquakes: a lecture by T. Sterry Hunt. New York, 1869. 8vo, pp. 16.

Description of a New Species of Grapta, and Notes on G. interrogationis. By J. A. Lintner. 8vo, pp. 8. 1869.

Abhandlungen der Naturwissenschaftliche Verein zu Bremen. Bd. 2. Heft. 1.

Entomological Verein zu Stettin. 30 Jahr. Nos. 1-3. Jan.—Mch., 1869. 8vo.

From the Kongliga Svenska Vetenskaps-Akademien, Stockholm.—*Handlingar.* 1864-7. 4to. —*Ofversigt*, 1865-68. Vols. 22-25.—*Meteorologiska Iakttagelser*, 1864-6. 4to.—*List of Members*, 1865-9.—*Sketch of Geology of Spitzbergen*, by A. E. Norden. 8vo, plates and maps.—*On some Fossils found in the Eophyton Sandstone at Lugnas in Sweden*, by J. G. O. Linnarsson, 8vo.—*On the Existence of Rocks containing Organic Remains in fundamental Gneiss of Sweden.* 8vo. —*Om Gotlands nutida Mollusker* of G. Lindstrom. 1868.—*Conspectus Avium Picinarum*, by Sundeval.—*Thieracten des Aristoteles*, by Sundeval.—*Hemiptera Africana*, by C. Stal. Vols. 1-4.—*Lefnad Steck ninger*, etc. Bd. 1, Heft, 1.

Report of the Commissioner of Agriculture for the year 1868. 8vo, pp. 671. Washington, 1869.

Notice of New Mosasauroid Reptiles from the Greensand of New Jersey; Description of a New and Gigantic Fossil Serpent from the Tertiary of New Jersey; Description of a New Species of Protichnites from the Potsdam Sandstone of New York. By O. C. Marsh. 2 pamphlets, 8vo. [Extracted from American Journal of Science, 1869.]

Le Naturaliste Canadien. Vol. ii. No. 1. Dec., 1869. Quebec.

The American Horticultural Annual for 1870. 12mo, pp. 150; and *The American Agricultural Annual* for 1870. 12mo, pp. 150. New York. Orange Judd & Co. 50 cts. each.

On the Nature of the Movements involved in the Changes of Level of Shore Lines. By N. S. Shaler. 8vo, pamph. pp. 11. [From Proceed. Bost. Soc. Nat. Hist.] 1868.

On the Proximate Composition of Several Varieties of American Maize. By W. O. Atwater. pp. 9. [Extracted from Amer. Journ. Sci. and Arts.] 1869

Beast, Bird and Fish. By B. G. Wilder. [From Harper's Magazine, 1869.]

Notice of the Crustacea collected by Professor C. F. Hartt on the Coast of Brazil in 1867, together with a List of the described species of Brazilian Podophthalmia. By SIDNEY I. SMITH. [From the Trans. Connecticut Acad. of Arts and Sciences. Vol. ii.] 8vo, pp. 42. Plate. 1869.

Hindrances and Helps to the Advancement of Agriculture. By George Buckland. 8vo, pp. 52. Albany. New York State Agricultural Society. 1869.

Synopsis of Corals and Polyps of the North Pacific Exploring Expedition. Part iv. Actinaria, with Supplement and Geographical List. By A. E. Verrill. pp. 70. Plates. [From Proceed. Essex Inst. Vols v-vi. 1868-69.]

Notes on the Geology of Western Texas and of Chihuahua, Mexico. By James P. Kimball. [From Amer. Journ. Sci., 1869.] pp. 11.

Tidsskrift for Populære Fremstillinger af Naturridenskaben. Oct., 1869. 8vo. Kjobenhavn.

Annals of the Lyceum of Natural History of New York. Vol. ix, No. 8. December, 1869.

Mammalia of Massachusetts. By J. A. Allen. Bulletin of the Museum of Comparative Zoology. No. 8. pp. 143-253. 1869.

American Journal of Numismatics. Vol iv. No. 8. Dec., 1869. New York.

The Chemical News, with American Supplement. Dec., 1869. Vol. v, No. 6.

The Annals of Iowa. October, 1869. Davenport. 8vo.

Report upon Deep-Sea Dredgings in the Gulf Stream, during the Third Cruise of the U. S. Steamer Bibb, addressed to Prof. B. Peirce, Supt. Coast Survey, by L. Agassiz. Bulletin of the Museum of Comp. Zoology. No. 13. 8vo, pp. 363-386. Cambridge, 1869.

American Bee Journal. December.

Bulletin of the National Association of Wool Manufacturers. Vol. i, No. 4. Oct., 1869. Boston. 8vo, pp. 397-419.

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Land and Water. Nov. 6. 13. 20. 27. London.

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GLOSSARY.*

Accipitres. The Hawks, Falcon, and Eagles.
Achromatic. Free from color.
Amœboid. Like Amœba, an animal of a soft, jelly-like structure and no specialized organs.
Ambulacra. The narrow spineless zones, perforated by the fleshy suckers of the Sea-urchins and Starfishes.
Anadromous (Gr. *ana*, upwards; *dromos*, course). Relating to the classes of fish that pass at certain seasons, from the sea into the rivers.
Apical. Relating to the apex or top.
Archæopteryx. A fossil reptile-like bird.
Amnios. The membrane that surrounds the fœtus in the womb.
Azotized. Impregnated with azote, nitrogen.

Cardiac. Relating to the heart.
Cecidomyian. Relating to a family (Cecidomyidæ) of Diptera.
Carapace. Shell of turtles and other reptiles.
Chlorophyl (Gr. *chloros*, green; *phullon*, a leaf). The green matter in plants.
Chironectes (Gr. *chir*, hand; *nectes*, a swimmer). The Yapock. A genus of marsupial animals with webbed feet.
Columellar. Relating to the columella, or central axis of a shell.
Copepoda. An order of minute Crustaceans, or Crabs.
Coracoid. A large, flattened bone, passing from the shoulder-joint to the sternum.

Dinosaurs (Gr. *deinos*, terrible; *sauros*, a Lizard). An order of fossil reptiles.

Foraminifera (Latin, *foramen*, a hole; *fero*, to carry). Perforated shells secreted by an Amœba-like animal, and belonging to the Protozoa, or lowest branch of the animal kingdom.

Gasteropoda. Mollusca, generally with a single coiled shell and the creeping disc or foot below, as in the snails.
Globigerina. A genus of Foraminifera.
Graptolites. Fossils of the Silurian period; probably Jelly-fish, or Hydroids.

Heterocercal. Fishes with the upper lobe of the tail larger than the lower.
Hexapodous. Relating to an animal with six feet.
Holothuria. A genus of the Echinoderms (Sea-cucumbers).
Hydrozoa. The Jelly-fish, or Acalephs.

Lemurs. A genus of Quadrumana, or Monkeys.
Lepidosirens. A genus of the Batrachians closely allied to the fishes in some of their characteristics.
Lingula. A genus of the Brachiopods, or Lamp Shells.

Marsupial (Gr. *marsupion*). Pertaining to an order of Mammalia, which carry the young in a pouch.
Mesentery. A fold of the membrane lining the abdominal cavity, which suspends and holds in place the small intestine.
Mésas. Name given to the elevated plains west of the Rocky Mountains.
Metatarsal. Relating to the metatarsus, or instep bones.
Miocene. The second division of the Tertiary epoch.
Monotremata (Gr. *monos*, single; *trema*, a hole). An order of Mammalia with a single orifice posteriorly into which the genitals and intestine open.

Negundo.† A genus of timber-trees, having pinnated leaves and apetalous flowers.
Neural. Pertaining to a nerve.
Nullipore (*nullos*, none; *porus*, a pore). A genus of Corallines, or plants of a low order, which cover themselves with a limy secretion.
Notochord. Chorda dorsalis of the embryo, usually replaced by the spinal column of the adult.

Odontoid. Resembling a tooth.
Operculum (*Operio*, to cover). The bones which protect the gills of fishes. In Mollusks the valve which closes the shell of a snail.
Ovoviviparous. Animals which hatch their young from an egg within the body, their young being excluded alive.

Pseudova. False-eggs, as in the ovary of the asexual Plant-lice.
Phryganidan. Relating to the Phryganidæ, a family of insects containing species of Caddice-flies.
Picrotoxia (Gr. *pikirs*, bitter; *toxikon*, poison). The poisonous principle of an East Indian plant.
Plesiosaurians. Fossil reptiles of the Jurassic Period, with a long snake-like neck and short boat-like body.
Protoplasmic. Soft, structureless animal matter, such as the sarcode of Amœba.
Proteus. A genus of Batrachians, or naked reptiles such as the frog and salamander, or water newt.

Ramus. A twig or branchlet.
Rhizopods (Gr. *riza*, a root; *pous*, a foot). A

* No terms are explained here which can be found in the Glossary of Vols. I and II.
† The derivations and meaning of botanical names are fully given in Gray's Manual of Botany.

class of minute animals, including the Foraminifera.

Sarcode. The jelly-like tissue of the Amœba, sponges, etc.
Sertularian. Relating to Sertularia, a genus of Jelly-fish (Hydroids).

Tarsus. The heel and ankle bone.
Teratology (Gr. *teras*, a monster; *logos*, a discourse). A branch of science which treats of the monstrosities and malformations of the animal and vegetable kingdoms.
Tibia. Large bone of the human leg, the shin bone.
Tracheæ. The air vessels of insects, serving as lungs.
Triton. A genus of Salamanders.
Trochiform. Like the Trochus, a genus of marine Gasteropods; top-like.
Tubularia. A genus of jelly-fish (Hydroids).

Vascular. Containing blood-vessels, or relating to the circulatory system.
Visceral. Relating to the intestines and other organs of digestion.

INDEX TO VOLUME THREE.

George Peabody,

BORN IN DANVERS, MASS.,

FEBRUARY 18, 1795.

DIED AT LONDON,

THURSDAY, NOVEMBER 4, 1869.

Resolutions passed by the Peabody Academy of Science.

Resolved, — That the Trustees of the Peabody Academy of Science recognize, in the death of the distinguished founder of this Academy, the termination of a life actuated by a noble ambition to benefit and instruct mankind.

Resolved, — That here in his native county, among the many noble institutions he has founded, we are keenly sensible of the greatness of his work and the magnitude of our loss; yet a fame so pure and a life so grand leave nothing to be said in praise.

Resolved, — That, while the people of two continents are paying their tributes to his memory, we tender our sympathies to his kindred and friends in their bereavement; and rejoice that his life was prolonged to witness so much good accomplished by his wise and munificent charities, and the assurance of their great future usefulness.

Resolved, — That the President be instructed, in behalf of the Trustees, to coöperate with other institutions in paying proper respect to the memory of Mr. PEABODY, and in making the necessary preparations for his funeral.

Resolved, — That a copy of these Resolutions be sent to the immediate relatives of the deceased.